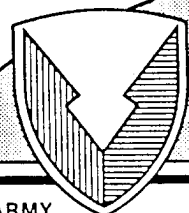


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PROGRAM MANAGER RMA CONTAMINATION CLEANUP

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

Rocky Mountain Arsenal

Draft Final
Technical Program Plan
FY88 - FY92

[Remedial Investigation/Feasibility Study/Interim
Response Actions]

December, 1987

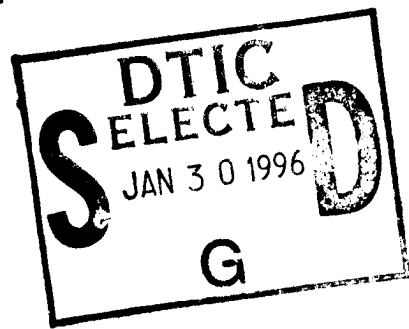
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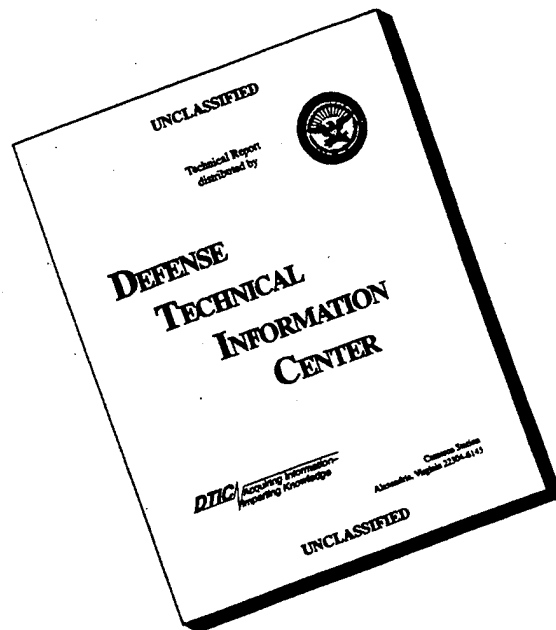
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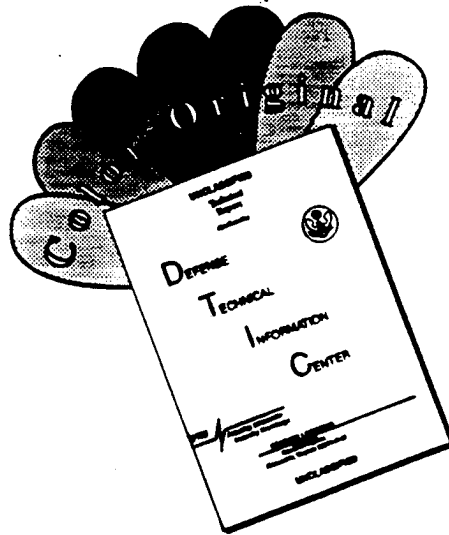
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LITIGATION TECHNICAL SUPPORT AND SERVICES

Rocky Mountain Arsenal

Draft Final Technical Program Plan
 FY88 - FY92
 (Remedial Investigation/Feasibility Study/
 Interim Response Actions)

December 1987

Contract Numbers: DAAK11-84-D-0016, DAAK11-84-D-0017

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1.0 INTRODUCTION

1.1 BACKGROUND

The Department of the Army (Army) commenced in October 1984 its Remedial Investigation/Feasibility Study (RI/FS) with respect to onpost and offpost contamination associated with the Rocky Mountain Arsenal (RMA).

All such RI/FS activity has been carried out in substantive compliance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). In addition, the Army has followed a process whereby no significant RI/FS activity has been undertaken in connection with RMA without the U.S. Environmental Protection Agency (EPA), Shell Oil Company (Shell), and the State of Colorado (State) receiving a meaningful opportunity to participate in the pertinent RI/FS decision making. In the ordinary course, this participation has taken the form of distribution of draft RI/FS task/technical plan to EPA, Shell, and the State for review and comment (with a meeting frequently being held in conjunction with the review period), followed by the Army responding in writing to all comments and making appropriate modifications of the draft plan.

By the early summer of 1987, the Army has completed most of the initial phases of its investigations of potential onpost and offpost RMA-related contamination. Thus, the Army felt it appropriate to take stock of what it accomplished to date, to discuss these achievements with the other parties to the RI/FS process and to endeavor to reach consensus with the other parties on the outstanding issues and the significant milestones remaining before the comprehensive cleanup of the RMA CERCLA site can commence. Accordingly, representatives of the Army, EPA, Shell, and the State met for extended periods throughout the summer and early fall of 1987 for purposes of thoroughly and freely discussing all significant aspects of the RI/FS.

This Technical Program Plan (Plan) is the result of these discussion and deliberations.

1.2 PURPOSE

The purpose of this Plan is to present a program, timetable, and deadlines for all presently identified Interim Response Actions (IRA) and all RI/FS activity for the two planned Operable Units at RMA.

This Plan has a goal of March 1989 for the issuance of the Army's preferred remedial strategy for the Offpost Operable Unit and a goal of February 1992 for the issuance of the Army's preferred remedial strategy for the Onpost Operable Unit.

This Plan also identifies the Products and Subproducts which shall proceed without substantial modification, those that are sufficiently completed at the time of preparation of the Plan, and those which require such substantial modification to warrant designation as New Products or Subproducts. This Plan also identifies any New Products or Subproducts that require identification of Applicable or Relevant and Appropriate Requirements (ARARs), identifies Other Deliverables (to the extent presently known), establishes deadlines for the completion of IRA Decision Documents, identifies RI/FS deadlines for significant milestones, identifies schedules, and addresses and resolves new issues concerning the general conduct of the RI/FS that have been clearly raised during the period for drafting and commenting upon this Plan. If New Products or Subproducts are identified during the period for commenting on this Plan, they shall be added to the RI/FS for the Onpost and Offpost Operable Units.

1.3 DEVELOPMENT AND ADOPTION OF PLAN

The "Rocky Mountain Arsenal Remedial Investigation/Feasibility Study Operable Units, Processes, Records of Decision, Administrative Records, Timetables and Deadlines, Enforceability, and Stipulated Penalties" document (RI/FS Process Document) governs the development and adoption of this Plan.

In essence, the RI/FS Process Document provides that, within 30 days of receipt, EPA, Shell, and the State will submit their written comments on the draft Plan to the Army. Thirty days later, the Army will transmit to the Steering and Policy Committee (SAPC) and to EPA, Shell, and the State:

- o A draft final Plan that designates the matters on which there is consensus and identifies the unresolved issues;
- o Copies of the written comments of EPA, Shell, and the State; and
- o The Army's response to all timely received written comments received from EPA, Shell, and the State.

Fifteen days after receipt of the draft final Plan with comments and responses, the SAPC shall meet to decide any unresolved issues, to reconcile any inconsistencies and to direct the finalization of the Plan in accordance with its decisions. If within 20 days of its initial meeting the SAPC cannot decide a dispute concerning the Plan, the Army, EPA or Shell may elevate the issue to the Final Review Committee (FRC) for resolution. Thereafter, the Army shall have 15 days to revise the draft final Plan in accordance with the SAPC's or FRC's directives and then to transmit a copy of the Plan to the SAPC. The SAPC shall approve the Plan on finding that it is consistent with the SAPC's or FRC's earlier directives. Following SAPC approval, copies of the finalized Plan shall be issued by the Army to EPA, Shell, and the State.

The RI/FS Deadlines shall then be appended to the RI/FS Process Document filed with the United States District Court for Colorado and shall thereafter apply to the RI/FS for the Onpost and Offpost Operable Units.

1.4 OVERVIEW OF PROCESS

Pursuant to the RI/FS Process Document, the signatories will follow an extensive process for the exchange of information and documents relative to the RI/FS. These documents and all other documents that are included in the administrative records for the Onpost and Offpost Operable Units shall be maintained in the Joint Administrative Record and Document Facility (JARDF) which shall be located on or near RMA.

Under the RI/FS Process Document, there shall be an RMA Committee which is to be responsible on a daily basis for ensuring the implementation of the RI/FS. In addition, there is to be a RMA Council which will hold regular meetings for purposes of reviewing and commenting on progress under the Plan, commenting on progress under each Technical Program Plan and on the

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status of all Technical Plans, Products, and Subproducts reports, and Other Deliverables, and for purposes of informally resolving any differences between the Army, EPA, and Shell. There is also to be a Technical Review Committee, composed primarily of local community representatives, that will provide a meaningful opportunity for these persons to become informed and to express their opinion about important aspects of the RI/FS. Significant disputes between the Army, EPA, and Shell shall be resolved by the SAPC and FRC.

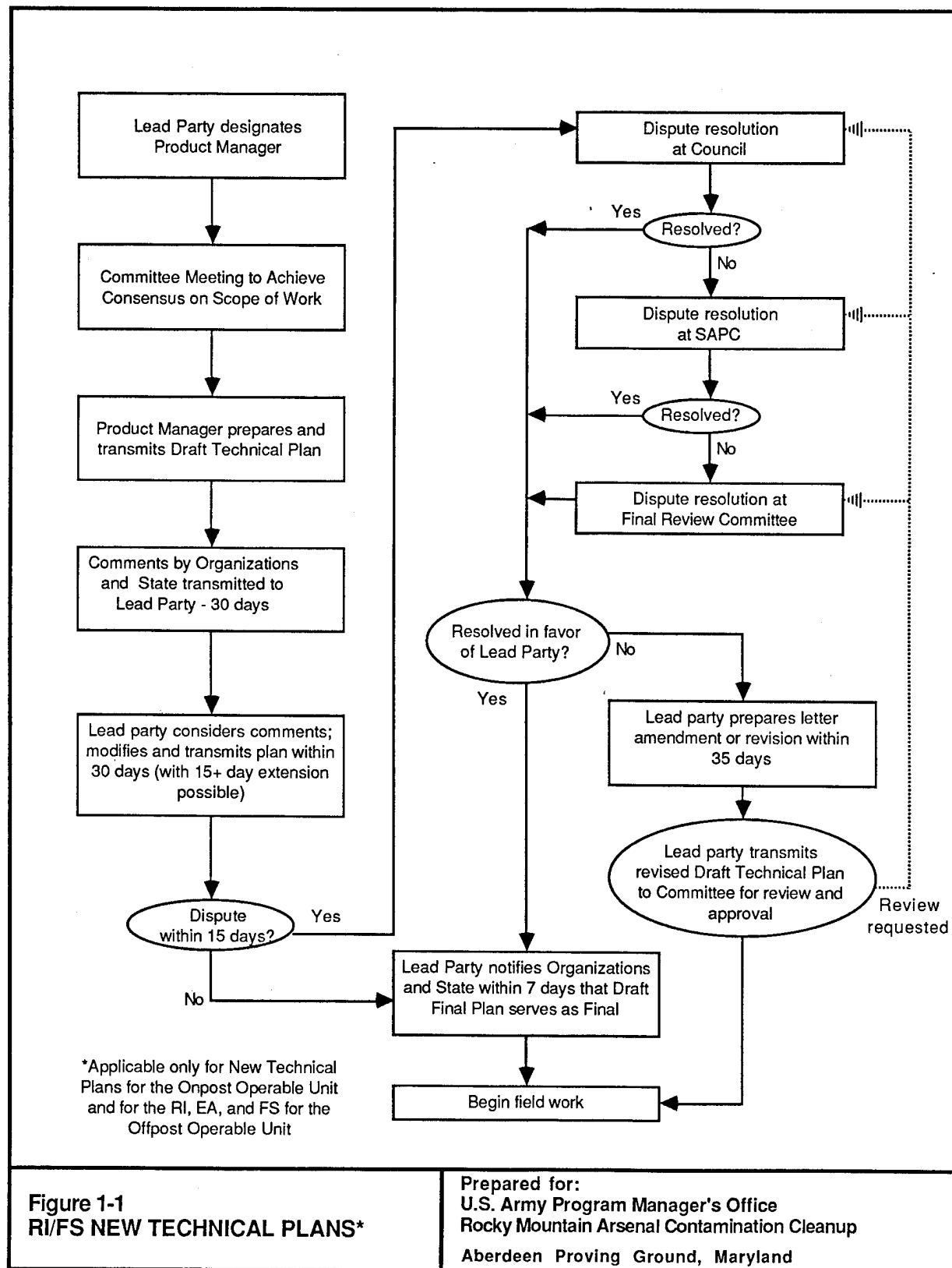
The RI/FS Process Document provides that there are to be no New Products or Subproducts for the RI for the Onpost Operable Units. However, New Products or Subproducts may be proposed for the endangerment assessment (EA) or FS for the Onpost Operable Unit and for the RI, EA, or the FS for the Offpost Operable Unit.

New Technical Plans shall be prepared by the respective proponents for all New Products and Subproducts. New Technical Plans constitute the only type of Technical Plan that is subject to Dispute Resolution (Figure 1-1).

Project Managers for New or Ongoing Products shall meet with the RMA Committee approximately every 60 days to review and discuss their progress.

Prior to the issuance of any draft Product or Subproduct report, counsel for the United States, Shell, and the State (and for the Department of Interior and the Agency for Toxic Substances and Disease Registry if they elect to participate) will meet to identify potential ARARs. All potential ARARs proposed at this meeting shall be considered by the Army in its preparation of the relevant Product report. The Army, as Lead Agency, shall be responsible for all ARAR determinations for a Product.

ARARs are to be designated in accordance with CERCLA, the NCP, and any EPA guidance that is not inconsistent with CERCLA and the NCP, including but not limited to ambient or chemical-specific requirements, performance, design or other action-specific requirements and locational requirements. The identification of ARARs for the RMA CERCLA site shall recognize that ARARs can be identified only on a site-specific basis and that ARARs depend on the specific hazardous substances, pollutants, or contaminants at a site, the



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particular actions proposed as a remedy, and the characteristics of the site. State ARARs shall also be identified, pursuant to Section 12(d) (2) (A) (ii) of CERCLA, where these are pertinent to a Product and not inconsistent with CERCLA, the NCP, and EPA guidance that is itself not inconsistent with CERCLA and the NCP.

For the Onpost Operable Unit, there shall be an opportunity for review and comment (and Dispute Resolution on draft final Product reports) for the following Products (see Figure 1-2).

RI Products

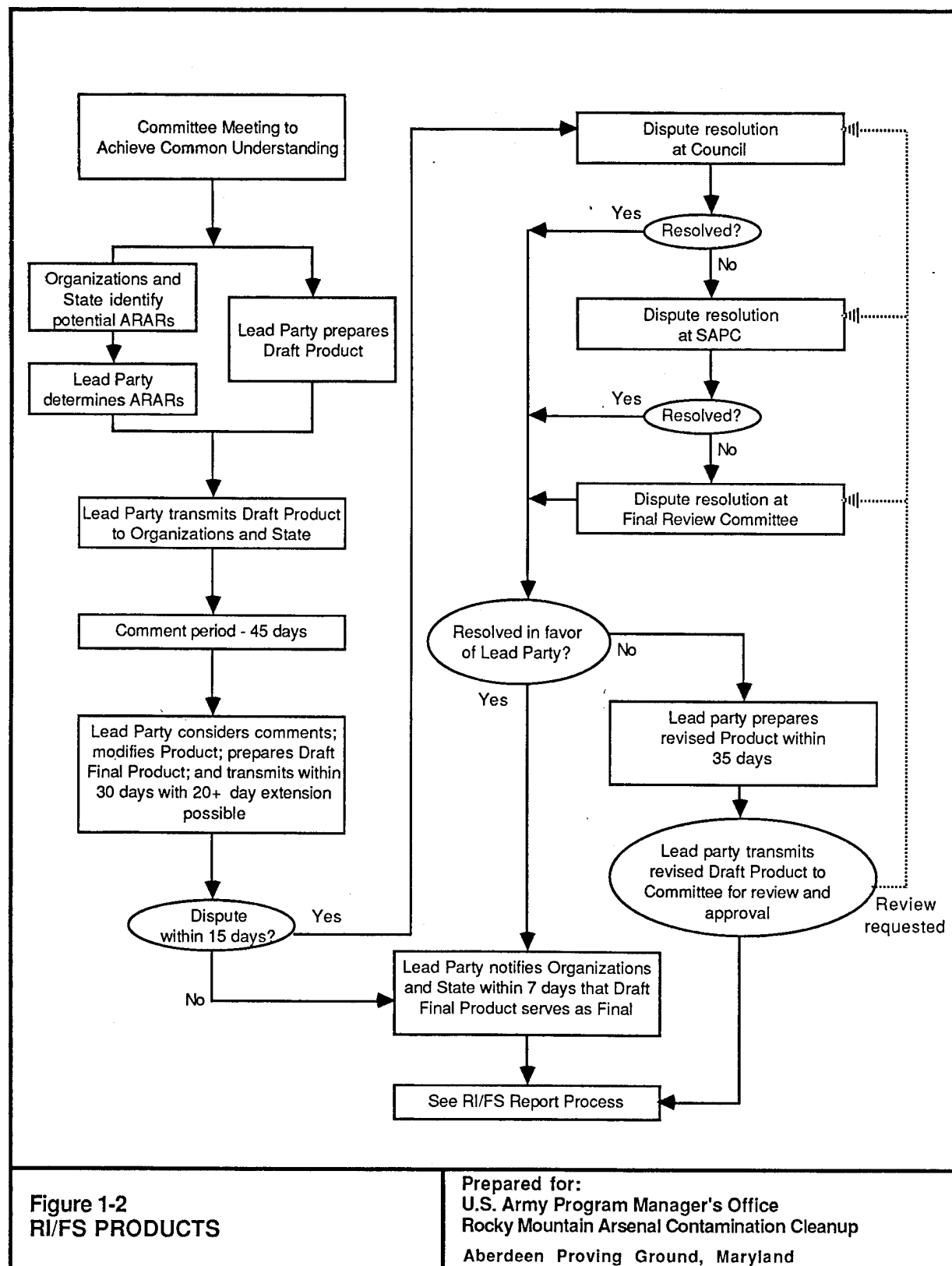
- o Air (results of Arsenal-wide air investigations);
- o Buildings (results of Arsenal-wide building investigations);
- o Biota (results of Arsenal-wide biota investigations);
- o Water (results of Arsenal-wide surface water and ground water investigations);
- o Onpost SARs (investigation of the results of air, buildings, biota, water, and soils investigations); and
- o RI (interpretation of all RI data presented in the RI Products).

EA Products

- o Contaminant Identification, with EA-related ARAR Determination (site characterization, selection of target contaminants, and identification of environmental transport and fate mechanisms, and ARARs for target contaminants);
- o Exposure and Toxicity Assessment (identification of exposure pathways and extent of exposure of human and environmental populations at actual or potential risk; evaluation of toxicological properties of target contaminants); and
- o EA, with revised EA-related ARAR Determination (development of target cleanup level ranges based on Risk Characterization and revised EA-related ARAR identification).

ES Products

- o Development and Screening of Alternatives, with ARAR Determination for Each Alternative (initial alternative



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screening process by which certain alternatives are selected for in-depth evaluation);

- o Evaluation of Alternatives, with Revised ARAR Determination (in-depth evaluation of alternatives resulting from initial screening; refinement of ARAR determination for each alternative evaluated); and
- o FS with Revised ARAR Determination (development of preferred alternative and final refinement of ARAR determination for that alternative).

For the Onpost Operable Unit, there shall be an opportunity for review and comment (but not Dispute Resolution) for the following Subproducts:

RI Subproducts

- o All Phase I Contamination Assessment Reports (CARs) for the Onpost Operable Unit (to be used in developing the RI Products described above).

EA Subproducts

- o Risk Characterization (determination of the likelihood and extent of any harm).

FS Subproducts

- o Technology Inventories (first step in Development and Screening of Alternatives);
- o Treatment/Incineration Study (for incorporation into Evaluation of Alternatives);
- o Disposal Facility Study (for incorporation into Evaluation of Alternatives); and
- o Advanced Technologies and Pilot Treatment Studies (for incorporation in Evaluation of Alternatives).

For the Offpost Operable Unit, the Army shall make available for review and comment (and Dispute Resolution on draft final Product reports) the following Products:

- o RI and EA-related ARAR Determination; and
- o EA and FS, with FS-related ARAR Determination.

Figure 1-3 presents a matrix linking Onpost and Offpost Operable Units Products and Subproducts to the tasks currently being conducted or planned

Task Number, Name*	On-Post Operable Unit											
	Sub-Products						Products					
	Remedial Investigation Concentration Assessment Reports (Soils, Sewers)	Endangerment Assessment Risk Characterization	Feasibility Study Technology Inventory	Feasibility Study Incineration Report	Feasibility Study Waste Disposal Facility Report	Feasibility Study Advanced Technology Report	Remedial Investigation RI Report	Remedial Investigation Buildings Report	Remedial Investigation Soils Report	Remedial Investigation Water Report	Remedial Investigation Study Area Reports (7)	Remedial Investigation Summary Report
0, Research	●	●	●	●	●	●	●	●	●	●	●	●
1, Section 36 Investigation	●										●	●
2, South Plants Investigation	●							●			●	●
4, Water Quantity/Quality Survey									●		●	●
6, Basins Area, Phase I	●										●	●
7, Lower Lakes, Phase I	●										●	●
TED, Advanced Technology			●			●					●	●
9, Bots Assessment								●			●	●
10, Sewers Investigation	●										●	●
11, Hydrazine Facility Investigation	●										●	●
12, Darby Lakes, Phase I	●										●	●
14, Army Sites North, Phase I	●										●	●
15, Army Sites South, Phase I	●										●	●
17, Incineration Feasibility Study			●	●							●	●
18, Air Monitoring							●				●	●
19, Basins Area, Phase II	●										●	●
20, Lakes, Phase II	●										●	●
21, Army Sites North, Phase II	●										●	●
22, Army Sites South, Phase II	●										●	●
23, Soil/Water Integration											●	●
24, Army Spills, Buildings	●							●			●	●
25, Boundary Systems Ground Water Monitoring									●		●	●
27, Landfill Feasibility Study			●		●							
28, Feasibility Study Alternatives Assessment			●									
35, On-Post Endangerment Assessment		●										
36, North Boundary System Response Action Assessment			●							●	●	●
38, Western Tier TCE Study	●									●	●	●
39, Off-Post Remedial Action Alternatives Assessment											●	●
42, North Plants Investigation	●							●			●	●
44, Ground/Surface Water Monitoring			●						●		●	●
45, Lab/Bench Scale Studies												
47, Supplemental Phase II Surveys, North	●										●	●
48, Supplemental Phase II Surveys, South	●										●	●
RMFS1, RFA, Bots, Water, SAPs, Exposure Assessment								●	●		●	
RMFS2, Feasibility Study Development and Screening of Alternatives												
RMFS3, Feasibility Study Modeling, Treatability Studies												
RMFS4, Remedial Investigation Summary												●
RMFS5, Risk Characterization/Endangerment Assessment		●										
RMFS6, Feasibility Study Evaluation of Alternatives												
RMFS7, Feasibility Study Summary												
RMFS8, RMFS to Record of Decision												
66, Oilpost Water												
CMP, Comprehensive Monitoring Program												

Figure 1-3
RI/FS PRODUCT/TASK MATRIX

at Operable Unit	Products	Offpost Operable Unit
Subproduct	Products	Products
Remedial Investigation Bios Report	Remedial Investigation Bios Report	Remedial Investigation Bios Report
Remedial Investigation Water Report	Remedial Investigation Water Report	Remedial Investigation Water Report
Remedial Investigation Study Area Reports (7)	Remedial Investigation Study Area Reports (7)	Remedial Investigation Study Area Reports (7)
Remedial Investigation Summary Report	Remedial Investigation Summary Report	Remedial Investigation Summary Report
Endorsement Assessment Exposure/Toxicity Assessment	Endorsement Assessment Exposure/Toxicity Assessment	Endorsement Assessment Exposure/Toxicity Assessment
Endorsement Assessment Summary (Risk and Endorsement Assessment)	Endorsement Assessment Summary (Risk and Endorsement Assessment)	Endorsement Assessment Summary (Risk and Endorsement Assessment)
Feasibility Study Alternatives Development/Screening	Feasibility Study Alternatives Development/Screening	Feasibility Study Alternatives Development/Screening
Feasibility Study Detailed Evaluation of Alternatives	Feasibility Study Detailed Evaluation of Alternatives	Feasibility Study Detailed Evaluation of Alternatives
Feasibility Study Summary with Preferred Alternative	Feasibility Study Summary with Preferred Alternative	Feasibility Study Summary with Preferred Alternative
Contaminant Identification with ARAPs	Contaminant Identification with ARAPs	Contaminant Identification with ARAPs
Remedial Investigation Contaminant Assessment Report	Remedial Investigation Contaminant Assessment Report	Remedial Investigation Contaminant Assessment Report
Remedial Investigation Summary with Endorsement Assessment ARAPs	Remedial Investigation Summary with Endorsement Assessment ARAPs	Remedial Investigation Summary with Endorsement Assessment ARAPs
Feasibility Study Summary Report with Endorsement Assessment	Feasibility Study Summary Report with Endorsement Assessment	Feasibility Study Summary Report with Endorsement Assessment

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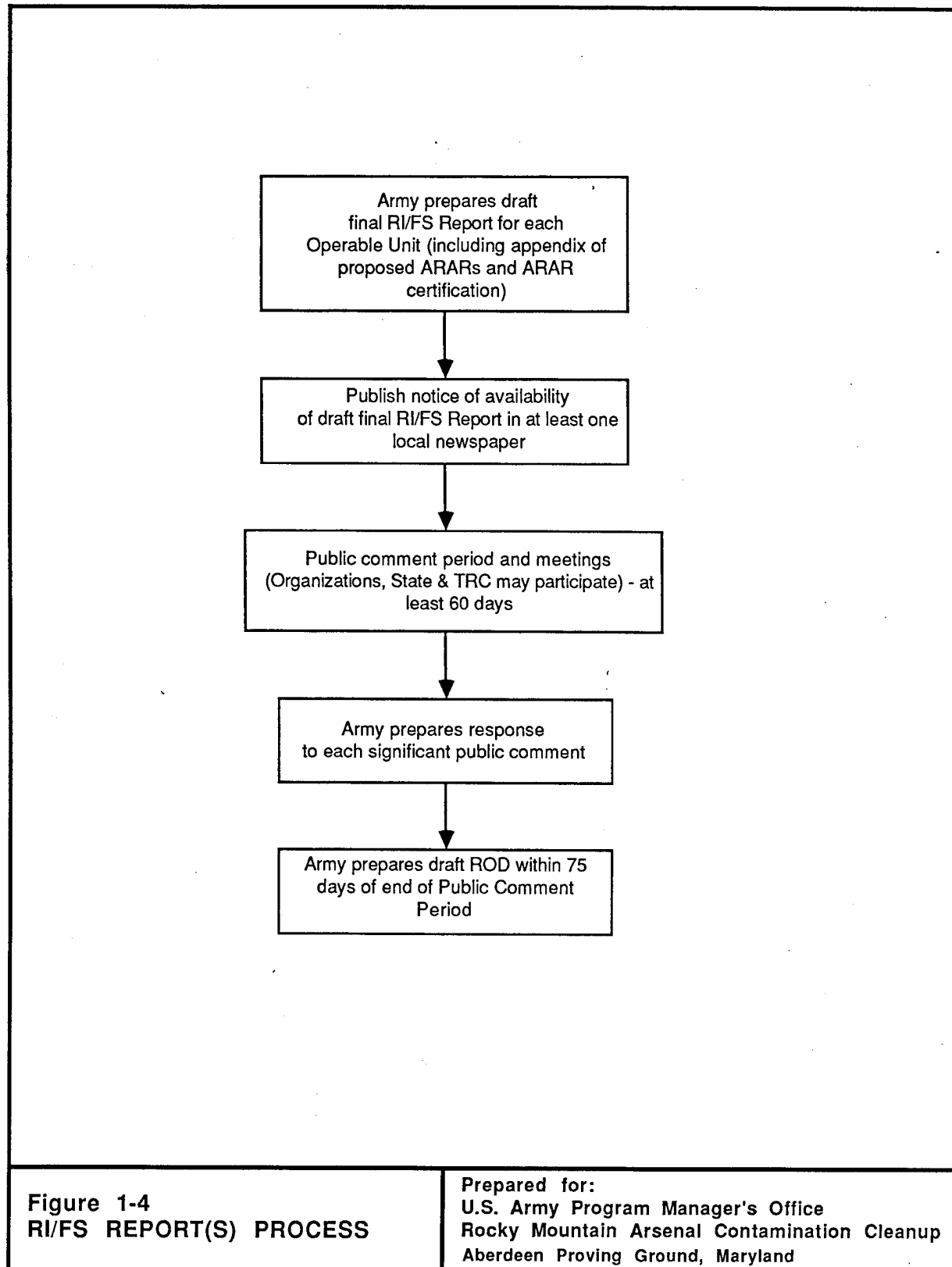
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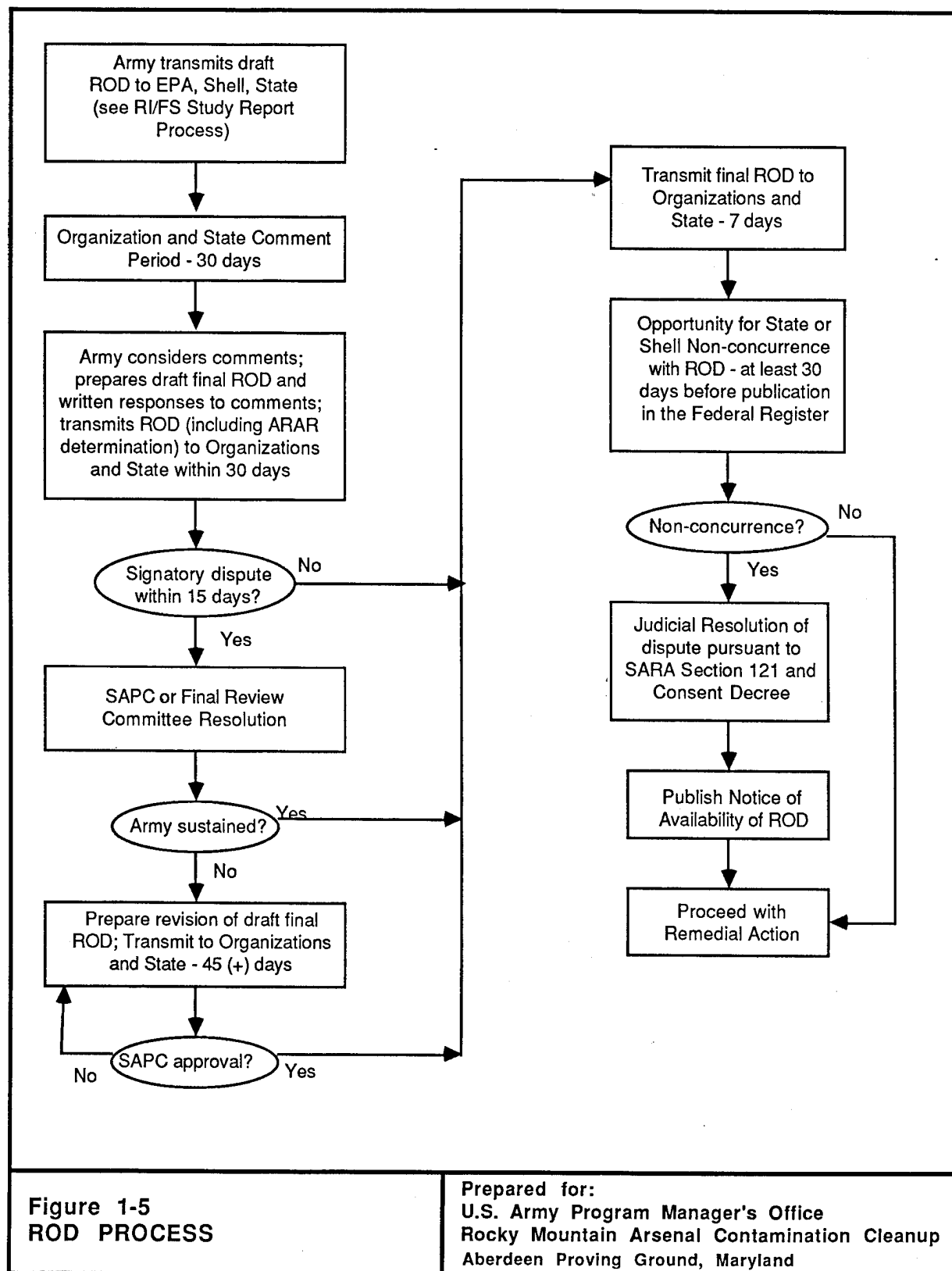
to be awarded. Following the finalization of all Product reports required for an Operable Unit, the Army shall prepare the RI/FS Report for the Operable Unit. Figure 1-4 illustrates the review process for the RI/FS Reports. Each RI/FS Report shall include the information and methodology used for site characterization, shall have an appendix that summarizes all ARAR determinations applicable to the RI/FS and present any necessary ARAR certification (including State standards compliance), and shall comply with any other CERCLA or NCP requirements or EPA guidance that is no inconsistent with CERCLA and the NCP. On or before the applicable deadline established in the Plan, the Army shall publish notice in one or more Denver newspapers of the availability of the RI/FS Report (with a brief analysis), invite public comment for at least a 60-day period, and conduct one or more transcribed public meetings at a location near RMA. Upon the close of the public comment period, the Army shall prepare a response to all significant comments which shall be included in the applicable Record of Decision (ROD).

Each ROD shall identify the remedial action selected for that Operable Unit, described all bases for the selection, summarize and respond to significant public comments received on the draft final RI/FS Report, provide Design Deadlines for response actions addressed in the ROD, provide an appendix of ARARs and an ARAR certification (including State standards compliance), and satisfy any other CERCLA or NCP requirement on EPA guidance that is not inconsistent with CERCLA or the NCP.

Generally, not more than 75 days after the conclusion of the public comment period on the RI/FS Report, the Army shall transmit the draft ROD to EPA, Shell, and the State for 30 days of review and comment (Figure 1-5). Following the close of the comment period and the making of all appropriate modifications by the Army, the draft final ROD shall be available for Dispute Resolution.

The Army shall then transmit a final ROD to EPA, Shell, and the State, shall advise the State that it intends to publicly announce the final ROD within 30 days, and shall submit the final ROD to the Court. The State and Shell may then seek judicial review, in accordance with CERCLA, if they so elect.





If neither the State nor Shell timely seeks judicial review, the Army shall announce the ROD in at least one major Denver newspaper and then proceed with the design and implementation of the response actions addressed in the ROD. If the State or Shell do bring a timely judicial challenge, the Army may nevertheless proceed with any design work that is unrelated or not inconsistent with the relief sought in such action, and may proceed with any other work determined to be appropriate by the Court.

1.5 RECORD OF DECISION

1.5.1 Description/Purpose

The ROD (declaration statement and supporting documentation) is the centerpiece of the administrative record. The ROD will contain an accurate and complete summary of the site, the threat it poses, and the selected remedy(s). The ROD will also describe the relative strengths and weaknesses of each alternative considered and offer a clear justification for the decision that was made.

Specific contents of the ROD will include:

- o A statement and justification that the selected remedy is protective and cost-effective, attains ARARs, and uses to the extent possible treatment technologies where all statutory requirements and preferences are fully satisfied.
- o A rationale will be provided justifying the preference of an alternative that is not a permanent solution, if an alternative is chosen that does not reduce the toxicity, mobility, or volume of contaminated media.
- o A statement regarding the choice of a final remedy that does not meet the statutory preference for treatment even though the remedy would still be protective and cost-effective. If the remedy is to be followed by a subsequently more permanent remedy, a statement will be made regarding the preference for the final remedy and the timeframe for implementation.
- o A description of the Federal and State requirements that were determined to be ARARs for RMA and will be met by the preferred alternative. Where ARARs do not exist for a specific contaminant,

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a description of the health-based level that will be met will be provided.

- o A statement on any ARARs that will not be met and the waiver that will be invoked to justify the non-attainment.
- o A summary of the responses to significant public comments on the selection of the alternative.
- o A timetable on the design and implementation of the remedial action.

1.5.2 Number of RODs

Two RODs are currently envisioned for RMA, one for addressing offpost remediation and one for addressing onpost remediation. The Offpost ROD will provide the information presented in the preceeding paragraphs as related to offpost contamination sources and receptors. The Onpost ROD will present similar information for onpost sources and for the control of migration from these sources to offpost receptors. Issuance of two RODs will permit the expedient selection and implementation of an offpost remedy while the investigation and procedural requirements for the more lengthy onpost activities proceed. Additional Operable Unit RODs may be created pursuant to the RI/FS Process Document.

As many of the actions that may be implemented for the control of migration of onpost contamination may affect offpost ground and surface water, biota, and air, it will be necessary to consider the impact of all onpost actions on these offpost media as well as on the remedial actions taken offpost. As required, the Offpost ROD will be reopened and revised to incorporate the associated impact of onpost actions. Additionally, and as appropriate, a ROD may be reopened to combine common technology operations to allow cost-reduction through economy of scale.

1.5.3 Level of Detail

The level of detail that will be presented in the RODs for the description of technologies or of alternatives will be consistent with interim EPA 1986 guidance. At a minimum, the RODs will state what technologies will be applied and the location, type, and amount of contaminated materials that will be affected by a particular technology. The desired performance goal

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that a process within the technology category would achieve will also be stated. Although the selection of the alternative will be at the technology level, the detailed evaluation of the alternatives (effectiveness, implementability, and cost) will be assessed using a specific process within the technology category (Figure 1-6).

For example, if biological treatment of extracted ground water is part of an alternative, then a process such as activated sludge could be used for the detailed evaluation. When the remedial action is proposed in the ROD, then any biological process which could match the performance goals of the process analyzed would also be eligible for final implementation. A list of eligible processes will be included for each of the technology categories included in the preferred alternative.

1.5.4 Inputs to the RODs

The contents of the RODs will consist of key findings from the RI/FS program. With respect to the three major components of the program (RI, EA, and FS), the following discussion lists the information within the RODs to be supplied by each of these components.

The RI will provide information to define the nature and extent of contamination at RMA using data depicting the locations and concentration profiles of contaminants. The RI will also contain information regarding the geology underlying RMA, and the hydrology of surface and ground water. The historical information of RMA collected prior to and during the RI will also be available to describe the activities that resulted in contamination.

The EA, in addition to identifying contaminant pathways and receptors, will contain the derivation of health-based criteria for contaminants for which ARARs do not exist. The EA will also provide information necessary to demonstrate the protectiveness of the selected remedial action.

The FS will provide information on the development and evaluation of various alternatives to be used by the decision maker in the selection of the preferred alternative. The FS will discuss how an alternative is protective

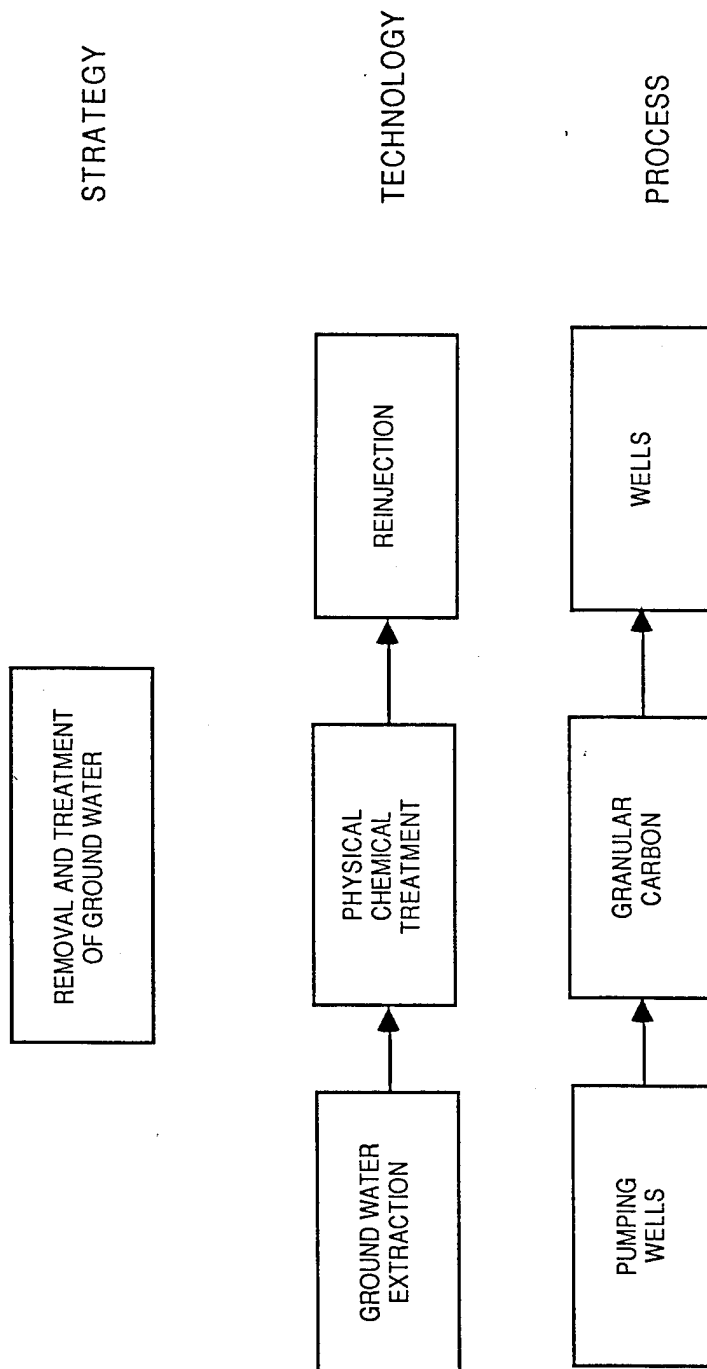


Figure 1-6

LEVEL OF DETAIL IN ALTERNATIVES ANALYSIS

Prepared for:
 U.S. Army Program Manager's Office
 For Rocky Mountain Arsenal
 Aberdeen Proving Ground, Maryland

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and cost-effective and will contain the ARARs that will be attained as well as those for which a waiver is sought for each of the alternatives considered.

The FS will provide a detailed description of alternatives including the associated technologies, performance goals, applicable materials and volume, and to what extent mobility, toxicity, or volume are reduced. For non-treatment alternatives considered, the FS will provide a discussion of the benefits of the alternative and the rationale for its consideration even though it does not achieve the treatment goals.

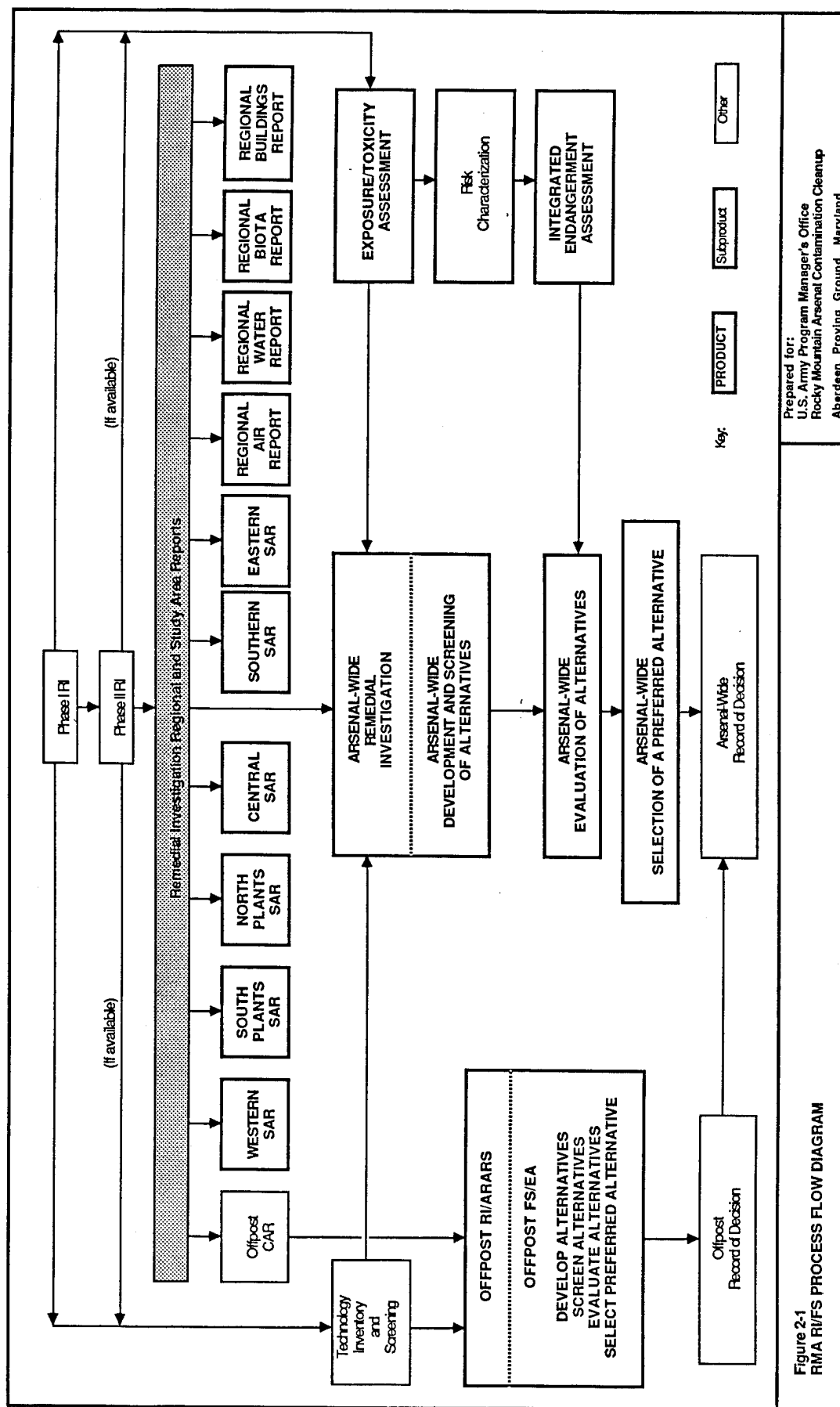
2.0 RI/EA/FS PROCESS

2.1 OVERVIEW

Although the RI/FS process at RMA is an iterative and interactive process in which information developed under the RI, EA, and FS is freely exchanged, it can also be summarized as a sequential progression of activities, presented in Figure 2-1. The RI data being collected at RMA fall under a large number of discrete task orders that are developed on the basis of contractual requirements. However, all of these data are being integrated and assessed on the basis of geographic areas or on an arsenal-wide basis in the case of contamination "media", namely air, water, biota, and buildings. These integrated data sets are then compiled into an overall RI for RMA.

The air, biota, and water categories are treated as separate RI entities ("media") because they do not, in a strict sense, represent sources of contamination. Rather, they can be thought of as migration pathways and receptors of contamination. Buildings are treated separately due to their unique character as centers of activities that once housed chemical and waste generation processes, and are not true contamination sources in themselves. The soils and sewers are so closely linked to one another that they must be considered together. Due to the magnitude and complexity of the information being developed for these categories, they are being handled within discrete geographic subareas (Study Areas) into which RMA has been divided. Figure 2-2 illustrates these Study Areas. Table 2-1 provides a listing of all of the potential contamination sites that have been identified on RMA, and it provides supplemental information such as the Study Area into which each site falls, the original contamination classification of each site as reported on the "tricolor" map, the Phase I and Phase II (as appropriate) tasks under which each site is being investigated, and a brief description of the type of activities that took place at the site.

Information developed in the RI for each site is used in the EA to select appropriate compounds and elements to be evaluated with respect to their toxicity and potential for exposure to living organisms. It is not logical to perform such assessments for compounds that are not found on RMA;



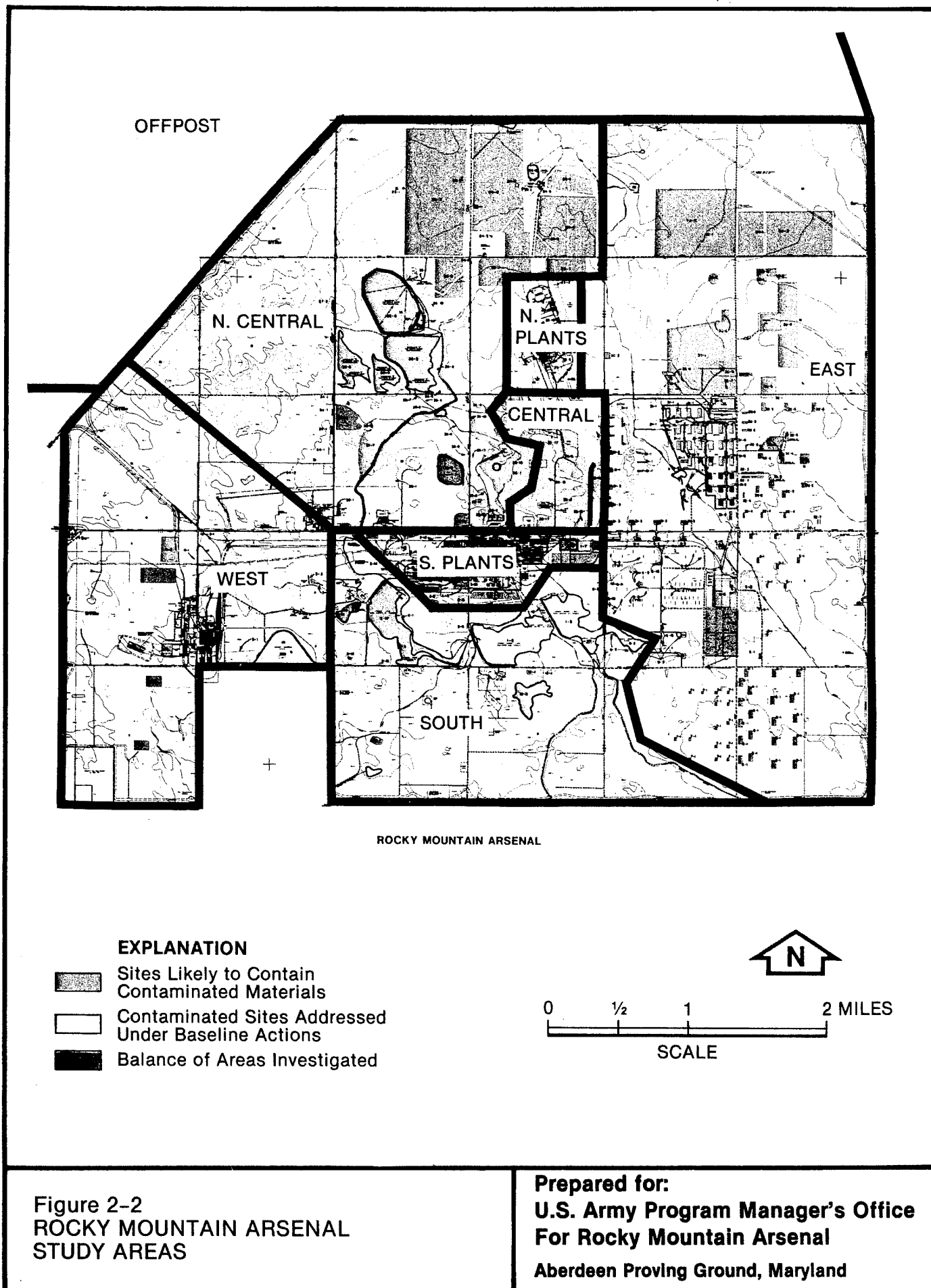


Table 2-1. Site Summaries (Page 1 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
1-1	Drainage Ditches	Pink	Ditches, Lakes, Ponds	South Plants/South	7	20	Separate CAR	Ebasco
1-2	Upper & Lower Derby Lakes	Pink	Ditches, Lakes, Ponds	South	12	20	Separate CAR	Ebasco
1-3	Mounded Material	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-4	Borrow Pit	Blue	Excavations, Surface Disturbances	South Plants	2	2	Separate CAR	Ebasco
1-5	Havelled Storage Areas	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-7	Hydrazine Blending and Storage	Pink	Storage Sites, Buildings, Equipment	South Plants	11	11	Separate CAR	Ebasco
1-8	Salvage Yard	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-9	Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plants	7	20	Separate CAR	Ebasco
1-10	South Tank Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-11	Sanitary Landfill	Blue	Solid Waste Burial Sites	South Plants	2	2	Separate CAR	Ebasco
1-12	Trash Dump	Pink	Solid Waste Burial Sites	South	12	20	Separate CAR	Ebasco
1-13	South Plants Area	Pink	Spills	South Plants	2	2	Separate CAR	Ebasco
2-1	Drainage Ditches	Blue	Ditches, Lakes, Ponds	South	7	20	Separate CAR	Ebasco
2-2	Firebreak (Burn Site)	Pink	Ordinance Testing and Disposal	South Plants	2	2	Separate CAR	Ebasco
2-3	Lagoon	Pink	Basins, Lagoons	South Plants	2	2	Separate CAR	Ebasco
2-4	Excavation or Ground Scar	Blue	Excavations, Surface Disturbances	South Plants	2	2	Separate CAR	Ebasco
2-5	Trench	Blue	Solid Waste Burial Sites	South	2	2	Separate CAR	Ebasco
2-6	Salt Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-7	Aeration Basin	Pink	Basins, Lagoons	South Plants	2	2	Separate CAR	Ebasco
2-8	Former Tank Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-9	Open Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-10	Location for Former Tanks	Blue	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-12	Former Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-13	Sanitary Landfill	Pink	Solid Waste Burial Sites	South Plants	2	2	Separate CAR	Ebasco
2-14	Ladora Lake and Mary Lake	Pink	Ditches, Lakes, Ponds	South	7	20	Separate CAR	Ebasco
2-17	South Plants Area	Pink	Spills	South Plants	2	2	Separate CAR	Ebasco
2-18	Drainage Ditch/Overflow Basin (Includes 3-3)	Pink	Ditches, Lakes, Ponds	West	7	20	Separate CAR	Ebasco
3-2	Overflow Basin	Pink	Ditches, Lakes, Ponds	West	7	20	With Site 3-2	Ebasco
3-3	Nonagon Spill Area	Pink	Spills	West	7	20	Separate CAR	Ebasco
4-2	Burning Pit	Pink	Solid Waste Burial Sites	West	15	22	Separate CAR	Ebasco
4-3	Burning Pit	Pink	Solid Waste Burial Sites	West	15	22	Separate CAR	Ebasco
4-4	Burning Pit	Pink	Excavations, Surface Disturbances	West	15	22	Separate CAR	Ebasco
4-5	Borrow Pit	Blue	Storage Sites, Buildings, Equipment	West	38	38	Separate CAR	Ebasco
4-6	Motor Pool Area	None	Storage Sites, Buildings, Equipment	West	15	22	Separate CAR	Ebasco
5-2	Area of Potential H and HD Contamination	Pink	Spills	East	15	22	Separate CAR	Ebasco
6-2	Upper Derby Lake	Pink	Ditches, Lakes, Ponds	South	12	20	Separate CAR	Ebasco
6-6	Former Toxic Gas Storage Yard	Pink	Storage Sites, Buildings, Equipment	East	15	22	Separate CAR	Ebasco
11-1	Buried Lake Sludge	Pink	Solid Waste Burial Sites	South	12	20	Separate CAR	Ebasco
12-1	Buried Lake Sludge	Pink	Solid Waste Burial Sites	South	12	20	Separate CAR	Ebasco
12-2	Rod and Gun Club Pond	Pink	Ditches, Lakes, Ponds	South	12	20	Separate CAR	Ebasco
19-1	Burn Site	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
20-1	Burn Site	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
24-6	Sewage Treatment Plant and Ponds	Pink	Ditches, Lakes, Ponds	North Central	7	20	Separate CAR	Ebasco
24-7	North Bog	None	Ditches, Lakes, Ponds	North Central	7	20	*New Site; Separate CAR Report	Ebasco
26-3	Basin C	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-4	Basin D	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-5	Basin E	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-6	Basin F	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-7	Surface Drainage from Basin A	Pink	Ditches, Lakes, Ponds	North Central	6	19	Separate CAR	ESE
26-9	Chemical Sewer Line	Pink	Sewers	North Central	14	21	Separate CAR	ESE
29-1	Burn Site	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
29-4	Disposal Area	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
29-5	Disposal Site (Includes 32.01)	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
30-1	Impact Area	Pink	Ordinance Testing and Disposal	East	14	21	Separate CAR	ESE
30-2	Burn Site	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE
30-3	H Training Area	Pink	Spills	East	14	21	Separate CAR	ESE
30-4	Sanitary Landfill	Pink	Solid Waste Burial Sites	East	7	20	Separate CAR	Ebasco
30-5	Demolition Operation Area	Pink	Spills	East	14	21	Separate CAR	ESE
30-6	Trenches	Pink	Solid Waste Burial Sites	East	14	21	Separate CAR	ESE

Table 2-1. Site Summaries (Page 2 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
30-7	Ground Disturbance	Pink	Excavations, Surface Disturbances	East	14	21	Separate CAR	ESE
31-4	New Toxic Gas Storage Yard	Pink	Storage Sites, Buildings, Equipment	East	15	22	Separate CAR	Ebasco
31-6	Storage Sheds	Pink	Storage Sites, Buildings, Equipment	East	15	22	Separate CAR	Ebasco
31-7	Storage Shed	Pink	Storage Sites, Buildings, Equipment	East	15	22	Separate CAR	Ebasco
32-5	Burning Pits	Pink	Solid Waste Burial Sites	East	15	22	Separate CAR	Ebasco
32-6	Burning Pits	Pink	Solid Waste Burial Sites	East	15	22	Separate CAR	Ebasco
32-6	Chemical Sewer Line	Pink	Sewers	North Central	10	10	Separate Chemical Sewers CAR(s)	ESE
33-2	Basin B	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
35-3	Drainage from Basin A	Pink	Ditches, Lakes, Ponds	North Central	8	19	Separate CAR	ESE
35-4	Munitions Test Area	Pink	Ordinance Testing and Disposal	North Central	14	21	Separate CAR	ESE
35-6	Firing Range	Pink	Ordinance Testing and Disposal	North Central	14	21	Separate CAR	ESE
35-7	Basin A	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-1	Incendiary Drop and Munitions Test Area	Pink	Ordinance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-2	Insecticide Pits	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-3	Lime Settling Basins	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-4	Mercury Compound Spill	Pink	Spills	North Central	1	1	Separate CAR	ESE
36-5	Probable Test Site	Pink	Ordinance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-6	Sanitary and Shell Disposal Sites	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-7	Open Chemical Drainage	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-8	Incendiary or Munitions Test Site	Pink	Ordinance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-9	Large Pit	Pink	Solid Waste Burial Sites	North Central	1	1	Separate CAR	ESE
36-10	Liquid Storage Pools	Pink	Basins, Lagoons	Central	1	1	Separate CAR	ESE
36-11	Pits or Trenches	Pink	Solid Waste Burial Sites	North Central	1	1	Separate CAR	ESE
36-12	Trenches	Pink	Solid Waste Burial Sites	Central	14	21	Separate CAR	ESE
36-13	Disposal Site	Pink	Solid Waste Burial Sites	North Central	1	1	Separate CAR	ESE
36-14	Burning Site	Pink	Ordinance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-15	Complex Disposal/Activity Sites	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-16	Possible Trench Disposal Sites	Pink	Solid Waste Burial Sites	North Central	14	21	Separate CAR	ESE
36-17	Ground Scars	Blue	Excavations, Surface Disturbances	Central	14	21	Separate CAR	ESE
36-18	Chemical Sewer Line	Pink	Sewers	North Central/Central	1	1	Separate CAR	ESE
36-19	Drainage Ditch	None	Ditches, Lakes, Ponds	North Central	1	1	"New" Site; Separate CAR	ESE
36-20	Potential Unlined Basin	None	Basins, Lagoons	North Central	1	1	"New" Site; Separate CAR	ESE
36-21	Dabris Pile from Basin A	None	Solid Waste Burial Sites	Central	1	1	"New" Site; Separate CAR	ESE
36-22	Uncontaminated Areas	None	None	South Plains/South	7	20	Separate CAR	Ebasco
36-23	Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plains	7	20	Included in uncontaminated areas	Ebasco
1-UNC	Uncontaminated Areas	Blue	Excavations, Surface Disturbances	South Plains	7	20	Included in uncontaminated areas	Ebasco
1-6	Ground Scar	Blue	Storage Sites, Buildings, Equipment	South Plains	7	20	Included in uncontaminated areas	Ebasco
2-UNC	Open Storage Area	Blue	Excavations, Surface Disturbances	South Plains	7	20	Included in uncontaminated areas	Ebasco
2-10	Pit	Blue	Excavations, Surface Disturbances	South Plains	7	20	Included in uncontaminated areas	Ebasco
2-11	Open Storage Area	Blue	Excavations, Surface Disturbances	South Plains	7	20	Included in uncontaminated areas	Ebasco
2-15	Uncontaminated Areas	Blue	None	West	15	22	Separate CAR	Ebasco
3-UNC	Uncontaminated Areas	None	None	West	15	22	Separate CAR	Ebasco
4-UNC	Uncontaminated Areas	None	None	West	15	22	Separate CAR	Ebasco
5-UNC	Bomb Storage Sites	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
5-1	Uncontaminated Areas	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
6-UNC	Drainage Ditches	Blue	Ditches, Lakes, Ponds	South/East	15	22	Included in uncontaminated areas	Ebasco
6-1	Storage Area	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
6-3	Salt from Mustard Demil	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
6-4	GB Spill	Pink	Spills	East	15	22	Included in uncontaminated areas	Ebasco
6-5	HE Storage Yard	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
6-7	Storage Sheds or Bunkers	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
6-8	Vegetation Stress	Blue	Excavations, Surface Disturbances	South	15	22	Included in uncontaminated areas	Ebasco
6-9	Trenches	Blue	Solid Waste Burial Sites	East	15	22	Included in uncontaminated areas	Ebasco
6-10	Trench	Blue	Solid Waste Burial Sites	East	15	22	Included in uncontaminated areas	Ebasco
6-11	Possible Excavation	Blue	Excavations, Surface Disturbances	East	15	22	Included in uncontaminated areas	Ebasco
6-12	Excavation	Blue	Excavations, Surface Disturbances	East	15	22	Included in uncontaminated areas	Ebasco
6-13	Open Storage	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco

Table 2-1. Site Summaries (Page 3 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
6-15	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
7-UNC	Uncontaminated Areas	None	None	South/East	15	22	Separate CAR	Ebasco
7-1	Bomb Storage Sheds	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
8-UNC	Uncontaminated Areas	None	None	East	15	22	Separate CAR	Ebasco
8-1	Bomb Storage Sheds	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
9-UNC	Uncontaminated Areas	None	None	West	15	22	Separate CAR	Ebasco
9-1	Ground Disturbance, Radio Tower	Blue	Excavations, Surface Disturbances	West	15	22	Included in uncontaminated areas	Ebasco
9-2	Excavation or Mound	Blue	Excavations, Surface Disturbances	West	15	22	Included in uncontaminated areas	Ebasco
11-UNC	Uncontaminated Areas	None	None	South	15	22	Separate CAR	Ebasco
11-2	Disturbed Area	Blue	Excavations, Surface Disturbances	South	15	22	Included in uncontaminated areas	Ebasco
12-UNC	Uncontaminated Areas	None	None	South	15	22	Separate CAR	Ebasco
19-UNC	Uncontaminated Areas	None	None	East	14	21	Separate CAR	ESE
19-2	TX Production Site	Blue	Excavations, Surface Disturbances	East	14	21	Included in uncontaminated areas	ESE
20-UNC	Uncontaminated Areas	None	None	East	14	21	Separate CAR	ESE
20-2	TX Production Site	Blue	Excavations, Surface Disturbances	East	14	21	Included in uncontaminated areas	ESE
22-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
23-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
23-1	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
23-2	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
23-3	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
24-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
24-1	Suspected TX Burial Site	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-2	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-3	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-4	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
25-UNC	Uncontaminated Areas	None	None	N. Cent./N. Plains/East	14	21	Separate CAR	ESE
25-1	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
26-UNC	Uncontaminated Areas	None	None	North Central	6	19	Separate CAR	ESE
26-1	Deep Disposal Well	Pink	Solid Waste Burial Sites	North Central	6	19	Included in uncontaminated areas	ESE
26-2	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	6	19	Included in uncontaminated areas	ESE
26-10	Lined Pond	Blue	Basins, Lagoons	North Central	6	19	Included in uncontaminated areas	ESE
27-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
27-1	Basin G	Blue	Basins, Lagoons	North Central	14	21	Included in uncontaminated areas	ESE
27-2	Ground Scar	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
27-3	Ground Scar	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
28-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
29-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
29-2	Ground Disturbances	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
29-3	Burn Site	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
29-6	Ground Disturbance	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
30-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
31-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
31-1	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	East	14	21	Included in uncontaminated areas	ESE
31-2	VX and GB Soil Contamination Warehouse	Pink	Storage Sites, Buildings, Equipment	East	14	21	Included in uncontaminated areas	ESE
31-3	Warehouse	Blue	Excavations, Surface Disturbances	East	14	21	Included in uncontaminated areas	ESE
31-5	Disturbed Ground	Blue	Excavations, Surface Disturbances	East	14	21	Separate CAR	ESE
32-UNC	Uncontaminated Areas	None	None	East	14	21	Separate CAR	ESE
32-1	Ground Scars	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
32-2	Ground Scars	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
32-3	Open Storage Areas	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
32-4	Storage Shed	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
32-7	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	East	15	22	Included in uncontaminated areas	Ebasco
32-8	Ground Disturbance	Blue	Excavations, Surface Disturbances	East	15	22	Included in uncontaminated areas	Ebasco
33-UNC	Uncontaminated Areas	None	None	West	15	22	Separate CAR	ESE
34-UNC	Uncontaminated Areas	None	None	West/North Central	14	21	Separate CAR	ESE
34-1	Scarified Ground	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
35-UNC	Uncontaminated Areas	None	None	North Central	6	19	Separate CAR	ESE
35-5	Ground Disturbance	Blue	Excavations, Surface Disturbances	North Central	6	19	Included in uncontaminated areas	ESE
35-8	Storage Area	Blue	Storage Sites, Buildings, Equipment	North Central	6	19	Included in uncontaminated areas	ESE
35-9	Cauls Holding Basin	Blue	Basins, Lagoons	North Central	6	19	Included in uncontaminated areas	ESE

Table 2-1. Site Summaries (Page 4 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
36-UNC	Uncontaminated Areas	None	None	North Central/Central	1	1	Separate CAR	ESE
Biota	Arsenal-wide	None	Biota	Arsenal-wide	9	9	Separate Biota CAR	ESE
Air Monitoring	Arsenal-wide	None	Air	Arsenal-wide	18	18	Separate Air Monitoring CAR	ESE
South Plants Regional Spill Sites	Manufacturing Area Arsenal-wide	Misc. Misc.	Spills Spills	South Plants South Plants	2 24	2 24	In South Plants SAR In South Plants SAR	Ebasco Ebasco
Buildings	Arsenal-wide	Misc.	Storage Sites, Buildings, Equipment	Arsenal-wide	24	24	Separate Buildings CAR	Ebasco
25-4	Building 1501	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-5	Building 1503	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-6	Building 1504	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-7	Building 1506	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-8	Building 1601	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-9	Building 1603	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-10	Building 1606	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-11	Building 1614	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-12	Building 1615	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-13	Building 1616	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-14	Building 1703	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-15	Building 1727	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-16	Manufacturing Areas	None	Spills	North Plants	42	42	In North Plants SAR	Ebasco
3-1	Sanitary Sewer Line	Blue	Sewers	West	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
4-1	Sanitary Sewer Line	Blue	Sewers	West	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
24-5	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
25-2	Sanitary Sewer Line	Pink	Sewers	N. Cent./N. Plants	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
26-8	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
34-2	Sanitary Sewer Line	Blue	Sewers	West/North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
35-1	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
Misc. Sanitary Sewers	Sanitary Sewer Lines	None	Sewers	Arsenal-wide	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
25-3	Chemical Sewer Line	Pink	Sewers	North Plants	10	10	Separate Chemical Sewers CAR(s)	Ebasco
36-20	Chemical Sewer Line	Pink	Sewers	North Central	10	10	Separate Chemical Sewers CAR(s)	Ebasco
Misc. Chemical Sewers	Chemical Sewer Lines	None	Sewers	S. Plants/N. Central	10	10	Separate Chemical Sewers CAR(s)	Ebasco

*UNC - Uncontaminated in Phase I but doing extended Phase I work
 UNC** - Site removed as individual source, combined with adjacent site(s)

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similarly, it is not logical to conduct extensive RI studies for compounds that are nontoxic or that have no possible exposure pathways to humans or other sensitive organisms. Clearly, interaction between the RI and the EA is essential to the preparation of a complete, yet efficient remedial plan for RMA.

Similarly, the information developed in the RI and EA is considered in the preparation of the FS. It is unreasonable to examine remedial technologies to deal with contaminants that are not found on RMA or that have no adverse effects upon humans or the environment. The FS must also have sufficient data available to evaluate all reasonable remediation strategies, so feedback to the RI is critical to ensure that adequate information is collected. The following sections of the Plan describe the ongoing RI, EA, and FS in more detail.

2.2 REMEDIAL INVESTIGATION

2.2.1 Data Collection/Assessment

Department of Justice (DOJ) historical research and analysis of the RMA site began in 1983. Documents produced during discovery in United States vs Shell (FED CIV 83-C-2379, Dist. of Colorado) were screened and filmed. The filmed documents have been programmed into special data base systems, which currently contain over 307,000 documents. Various manual indexing systems have been developed to augment electronic searching. Deposition transcripts have also been programmed into another computer system, thereby facilitating both simple and complex key-word searches of the, currently, 384 volumes of testimony taken during the depositions of 136 deponents in the consolidated Colorado cases, as well as the Shell insurance case [Shell vs Accident and Casualty Insurance Company of Wintherthur, et al. (Cal. Civ. No. 278953)] now pending in California. Additionally, 5,076 deposition exhibits have been identified and reviewed. The 58 Shell Interrogatory Responses, the 205 U.S. Interrogatory Responses, and the thousands of documents referenced therein, have been reviewed and analyzed. Also various reports, studies and plans, together with the RMA Histories, have provided additional information.

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For the last two years, a Technical Research Team, comprised of attorneys and paralegals, has organized the data by broad subject matter and date. These Fact Compilations became the basis for the drafting of Proposed Stipulations, and Responses and Comments on Proposed Stipulations, thousands of fact statements organized by narrower historical subject, and exchanged between the U.S., Colorado, and Shell in order to reduce the number of triable issues in the Colorado case. The stipulation process also involved reference to aerial photography (1945-1982), 36 groups of microfiche containing thousands of drawings, plans, and process flow diagrams (the subject of which can be computer-searched), personnel interviews, and onsite observations.

For nearly a year, the team, with the assistance of a chemical expert and in consultation with scientists and engineers, performed a detailed waste stream analysis of Army operations at RMA, and examined and critiqued a waste stream analysis of Shell operations prepared by Shell in 1984. Additionally, the team has been called upon to analyze various historical propositions, as case needs have dictated, and has reported its findings to DOJ litigators.

In March 1987, the team began the historical analysis of those sites being investigated for Rocky Mountain Arsenal Cleanup. The focus of research, consequently, shifted from subject matters and operations to geographic locations. Brought to bear upon this research has been the results of fact compilations, stipulations, waste stream analyses and other work, and in each individual assignment, new research, including exploitation of all data bases and computer systems, examination of drawings, plans and photographs, and interviews of personnel as appropriate.

Of particular importance in the ongoing historical research of RMA cleanup sites has been the initiation and performance of the process by a team that has been working with the subject matter and materials over a significant period of time.

The RI is designed to define the nature and extent of contamination on RMA to a degree sufficient to permit an assessment and selection of viable

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cleanup options for RMA. It is not designed to collect all possible information about contamination or the RMA ecosystem. The RI program is divided into five major categories, namely air, biota, buildings, water, and soils/sewers. In addition, the offpost area has been assessed as a separate program. The air, biota, buildings, and water investigations are being conducted under only a few tasks (18, 9, 2/24, and 4/25/44, respectively), whereas the soils portion of the program is included in 18 separate tasks. Of these 18 soils-related tasks, 2 are both soils and buildings tasks (2 and 24), 5 are both soils and water tasks (23, 38, 42, 47, and 48), and the remaining 11 tasks are strictly soils-related. One additional task (10) includes the sewers assessments. Table 2-1, shown earlier, lists all of the potential contamination sites being investigated under the onpost RI/FS program at RMA. This table also contains a listing of the task numbers under which the various investigations are being conducted as well as a description of which reports will contain the results of the investigations.

The approach being used for the air study is the implementation of a regional program in accordance with EPA guidance. The purpose of the program is to establish baseline conditions to determine if there are significant problems resulting from air emissions from RMA to on- or offpost areas, and to establish baseline conditions against which to compare pollutant levels attained during cleanup actions and after completion of cleanup activities. Event conditions are being evaluated to determine airborne contaminant levels during atmospheric situations favorable to high pollution events. Meteorological conditions are being monitored in order to predict the frequency of pollution events during future remedial actions.

The biota assessment program is designed to evaluate RMA contamination in plants and animals. This task is integrated with the soil and water tasks to determine chemicals of concern to biota and to define potential areas of exposure. Data are collected on the concentration of contaminants in the tissues of key species selected because of their importance in regional ecosystems. This information is analyzed to determine current conditions and relate contaminant levels to observed effects. Plants and animals are collected from known or potentially contaminated areas and from control areas to compare levels of contaminants in selected tissues. Additional

information on food habits, population densities, etc. are compiled and evaluated to assess the hazards to key plant and animal species. Information on bioaccumulation, bioconcentration, depuration rates, etc. are incorporated into food web models to evaluate potential hazards to consumers, including humans, and to develop criteria for the cleanup of soils which serve as sources of contamination on RMA. Field studies of raptors, including the endangered bald eagle, are also conducted to determine the habitats used, food habits, abundance, distribution, and seasons of use on and near RMA.

The study of buildings on RMA is complicated because there are no commonly accepted techniques for thoroughly sampling buildings to determine their contamination status. As a result, the program developed for RMA relies principally upon a very thorough analysis of all available historic documentation concerning the buildings to determine their contamination classification. Buildings are grouped into one of three classes: probably contaminated, probably contaminated but cleanable, and unlikely to be contaminated. The program is supplemented with a limited dust and liquids sampling program, as well as with limited asbestos sampling. The output of the buildings investigations is a catalog and inventory of all structures present on RMA, along with a summary of all significant historic documentation for each of approximately 1,200 structures present or formerly present onpost. Estimates of the volume of materials contained in the buildings are also being made.

As discussed, the sewer systems have been incorporated into the soils/sewers program. There are three sewer systems present on RMA, the sanitary, chemical and process water systems. Portions of the chemical sewer system have been removed to prevent the continued introduction of wastewaters into Basin F.

The sanitary and process water systems remain intact. Sewers act not only as potential contamination sources due to exfiltration of contaminated materials from leaking joints, manholes, and pipe breaks, but also as pathways for contaminant movement. Contaminated ground water can potentially enter the sewer through joints and other discontinuities, travel

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through the system, and exfiltrate into the soils and ground water in other locations. The approach being used to investigate the sewers is two-fold. First, one of the IRAs will provide for the sewers to be plugged at key locations to cut off contaminant migration routes. Second, the three systems are being investigated as potential soils and ground water contamination sources. Sewers are unique potential contamination sources because they are linear and are likely to leak only at discrete, but difficult to identify, points along their length. There are thousands of possible leak locations, and it is not reasonable under the RI program to sample each of these locations. A "worst case" approach has been developed. Historical documentation and visual inspections are used to identify those lines in the worst condition, and sampling is initiated along these segments. Results from these segments are extrapolated to other portions of the intact and removed sewer systems.

The soils investigations are being conducted in two phases. Phase I programs are designed to identify the types of contaminants present at each site, whereas the Phase II programs are designed to verify the Phase I information and to better define the spatial extent of contamination. Screening methods (GC/MS for organics) are used in the Phase I program to identify the types of contaminants present. The methods used for Phase I screening are selected based upon a review of the types of compounds used and produced at RMA. A target list of compounds is used to guide the program, but significant man-made nontarget compounds detected under the Phase I program are also investigated further under the Phase II efforts. More sensitive and selective confirmatory analytical methods (GC methods for organics) are used in the Phase II programs to further define the extent of contamination at each site. The Phase II analytical methods for organics are supplemented with further GC/MS efforts to confirm the identity of compounds detected through the GC methods.

Table 2-1 lists the Phase I and, where appropriate, the Phase II task numbers for each potential contamination site. Some sites have no Phase II investigation planned based upon the lack of significant contamination found under the Phase I effort. There are 175 potential soils contamination sites being investigated onpost under the RI/FS program. These soils sites

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consist of 81 sites that were determined to have a high likelihood of being contaminated (pink on the tricolor map), 61 sites that were investigated but determined to have a low likelihood of being contaminated (blue on the tricolor map), 5 newly identified sites (not shown on tricolor map), and 28 sites that represent those portions of the 28 sections comprising nonsource areas of RMA for which no historical documentation exists indicating the possibility that contamination could be located. (An additional 9 sites were included under the sewers program and 12 sites under the buildings programs.)

The sampling strategy for the suspected contaminated areas consists of vadose zone sampling with a boring spacing determined by the relative size of the site under study. Samples are established on a grid pattern except where there is sufficient information to locate the samples within the most highly contaminated portions of a site, e.g., within waste burial trenches. The vertical distribution of sampling is based upon a regular 5 or 10 foot sample spacing, except where there is visual or other evidence that a different sampling strategy is appropriate. Saturated zone samples are collected at only a few locations where there is evidence that significant amounts of contamination have been emplaced or migrated below the water table. The "uncontaminated" or nonsource areas presented the greatest challenge in that there is no commonly accepted sampling method that could be accomplished in a reasonable timeframe that would give statistically meaningful proof that the area was indeed free of all possible contamination. As a result, an approach similar to that used for the buildings is employed, i.e., principal reliance upon a thorough search of historical documentation and aerial photographs supplemented with on-the-ground site reconnaissance and a limited soil sampling program. In addition, information collected from the ground water program is used to identify contaminant plumes that have unknown sources.

For the potential soils contamination sites, the results of the Phase I field investigations are presented in CARs. These reports, which are prepared on a site-by-site basis, contain all information that was developed through a search of historical documentation and aerial photographs as well as the results of the field sampling, chemical analysis, geologic interpretations, and analysis of the presence and extent of contamination.

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Where appropriate, a Phase II program to further define the spatial extent of contamination is also proposed in the Phase I CAR. Finally, a revised estimate of the volume of potentially contaminated soil is presented. Results of Phase II investigations are presented in Phase II Data Packet Addenda. These Phase II addenda are simple data presentations without re-interpretation of the nature and extent of contamination at that particular site. It was believed that a site-by-site interpretation of the complete soils contamination data set to be collected under the RI program would not properly take into consideration the interactions of various sites amongst one another, nor would it elucidate the interrelationships between soils contamination and ground and surface water contamination. Furthermore, the impacts of unique site types such as buildings, spills, and sewers upon contaminant distribution and movement are best addressed in the context of study areas, as discussed below.

Ground water investigations are currently being performed at RMA on both regional and site specific scales. The purpose of the regional monitoring program is to collect water quality and water level data from a large network of wells situated in both onpost and offpost areas. This program is responsible for the identification of the nature and extent of contamination on an Arsenal-wide basis and to provide continued monitoring of regional water quality. Site-specific ground water investigations and monitoring programs have been designed to accomplish specific objectives within a limited area. The objectives of each of these investigations or programs are different, but data from each of these programs will be merged with the regional water quantity/quality data to provide for comprehensive ground water interpretations.

The current regional ground water monitoring program (Task 44) included the measurement of water levels for over 800 monitoring wells and collection of water quality samples from more than 300 monitoring wells. This regional network was designed by evaluating the characteristics of all monitoring wells present in both the onpost and offpost areas of RMA (over 1,500 wells). Well construction, chemical sampling history, well location, and screen placement were factors considered in monitoring network design. Samples taken from wells selected for the past regional program (Task 4) and

the current regional program (Task 44) are analyzed for a wide variety of target analytes. A limited number of wells (10 percent) from later sampling events under Task 4 and from the Task 44 program had water samples analyzed for nontarget analytes by GC/MS methodologies. Although GC/MS methods do not achieve the lower detection limits of the GC methods used for target analytes, the use of these methods allows confirmation of many target compounds and tentative identification of nontarget compounds. As appropriate, nontarget compounds are included in the list of target analytes.

In addition to performing regional ground water monitoring, the Task 44 program constantly evaluates new water quality data so future monitoring networks can be modified, as necessary, to more effectively accomplish program objectives. The regional program also identifies locations and depths for which additional monitoring wells are needed to evaluate specific sites or plumes to achieve the objectives of the RI program. The installation of new monitoring wells on RMA is being coordinated by the "Composite Well Program" which is being conducted as part of Task 44.

Ground water monitoring is performed at both the North Boundary Control System (NBCS) and Northwest Boundary Control System (NWBCS) on a quarterly basis under Task 25. Water level and water quality data will be integrated with geologic and hydrologic interpretations for these areas to identify the nature and extent of contamination in the immediate vicinity of the boundary systems and also identify probable contaminant transport pathways.

Ground water monitoring and a hydrogeologic investigation are being performed in the offpost area under Task 39. The data generated under this task will be used to complete the RI for the offpost region, identifying probable contaminant transport pathways.

Another site-specific ground water investigation designed to identify sources of ground water contamination and characterize contaminant transport pathways has been performed for the Western Tier under Task 38. Task 26 has been rescoped to perform an IRA Alternative Assessment and install wells. No sampling and analysis is being conducted.

The Offpost RI is investigating water, air, biota, soils, and sediment media in the area immediately north and northwest of RMA. The primary emphasis is on RMA contaminants in ground water. The geologic, hydrologic, and chemical data will be used in subsequent EA and FS activities.

2.2.2 Data Interpretation

Data generated under both the regional program and site specific investigations will be integrated and interpreted to identify the nature and extent of contamination, probable source areas, and, to the degree possible, contaminant transport pathways.

As a result of these considerations, the final interpretation of the data collected on the individual soil contamination sites is conducted on a regional basis in Study Area Reports (SARs). These seven Study Areas (Southern, South Plants, Western, Eastern, North Plants, North Central, and Central) plus the separate Media reports for air, biota, buildings, and water, will form the basis for the integrated contamination assessment reports to be prepared as final RI Products. The Study Areas are also conveniently divided among the two contractor teams working at RMA in terms of the sites that each is investigating under its respective tasks. As shown below, the division of responsibility is relatively well-defined for each Study Area, except for the Eastern Area where a shared effort will be needed:

<u>Study Area</u>	<u>Number of Ebasco Sites</u>	<u>Number of ESE Sites</u>
Southern	22	0
South Plants	27	0
Western	17	0
Eastern	37	21
North Plants	1	0
North Central	2	49
Central	0	12
 <u>Media</u>		
Air	--	Arsenal-wide
Biota	--	Arsenal-wide
Buildings	Arsenal-wide	--
Water	Arsenal-wide	Arsenal-wide

Figure 2-2 illustrates the seven Study Areas that have been designated on RMA. The Study Area boundaries were developed in consideration of geography, geology, past land uses, contaminant classes and distribution patterns, ground and surface water flow patterns, and possible future uses. Table 2-1 lists the Study Areas into which each of the potentially contaminated sites falls. The SARs are developed in a more flexible format than the CARs due to the diversity of characteristics within each Study Area. In general, the following general format will be employed:

EXECUTIVE SUMMARY

1.0 STUDY AREA CHARACTERIZATION

HISTORY

GEOLOGY

HYDROLOGY

2.0 CONTAMINANT DISTRIBUTION

SOILS

GROUND WATER

SURFACE WATER

3.0 CONTAMINATION ASSESSMENT

The Study Area characterization is developed based upon information contained in the CARs for sites within the Study Area, as well as upon information developed in related activities such as ground water sampling and analysis for that area (and adjacent areas), sewers investigations, and buildings assessments. The discussion of contaminant distribution correlates data from adjacent or similar sites, and it correlates soils contaminant data with ground and surface water contaminant data. The correlations are conducted in graphical or statistical forms, depending upon the nature of the contamination and the area in question. The contamination assessment contains an interpretation of the observed contaminant distribution patterns, and a discussion of how these patterns may have originated, as well as how contamination patterns at adjacent sites might be related. Consideration is given to grouping sites by type. For example,

as shown in Table 2-1, sites have been classified into nine general categories, depending upon the types of uses or activities that took place, as follows:

<u>Site Type</u>	<u>Number of Sites</u>
Basins, Lagoons	15
Ditches, Lakes, Ponds	14
Excavations, Surface Disturbances	28
Ordnance Testing and Disposal	8
Solid Waste Burial	38
Spills	12
Storage Sites, Buildings, Equipment	47
Nonsource Areas	28
Sewers	14

The number of sites include areas that were not previously defined in the tricolor map. These site types are used on a Study Area basis to group similar contamination areas or patterns of migration. Other approaches to grouping contamination patterns are developed on a case-by-case basis to better understand the relationships between contaminant sources and migration and distribution patterns. The outcome of the SARs will be a comprehensive picture of the possible exposure routes and transport mechanisms for contaminants present on RMA. They also provide a basis upon which to evaluate various cleanup options, and thus form the principal input to the FS process.

2.3 ENDANGERMENT ASSESSMENT

The goals of the EA for RMA are to quantify the magnitude and probability of actual and potential damage to human health and the environment from contaminated soils at RMA, and to determine in-place concentrations of contaminants that will be protective of human health and the environment following cleanup.

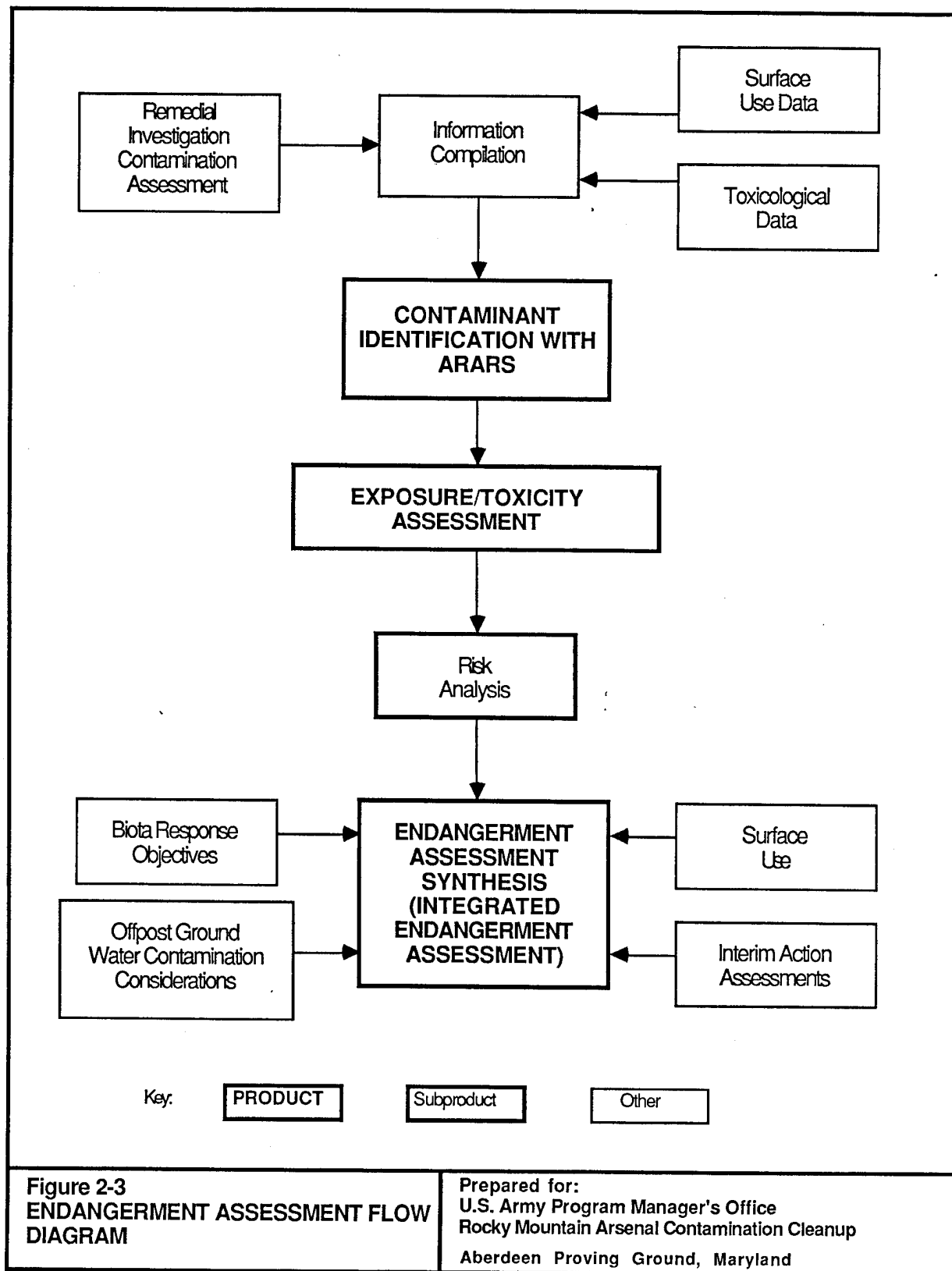
The EA approach used for RMA is consistent with the Superfund Health Evaluation Process and consists of a series of analytical steps which include the review of adjacent and site specific demographic data to determine the land use patterns and exposed populations; the determination of the magnitude and extent of contamination from the assessments performed in the RI; the identification of the contaminants present in soils and their toxicological properties; the development of numerical criteria for specific

exposure pathways and potential surface use options; the determination of the extent of exposure and endangerment to the target receptors; and the interpretation of the criteria data base to assist the FS in establishing response objectives.

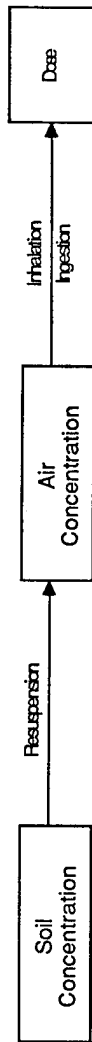
The analytical steps presented above are performed under six discrete study elements (sub-tasks) as shown in Figure 2-3. The method used to determine contaminant specific soil criteria has been developed by the United States Army Biomedical Research and Development Laboratory (USABRDL) and has been extensively used by the Department of the Army at a number of sites among which are the West Virginia Ordnance Works, Alabama Army Ammunition Plant, Savannah Army Depot, and Cornhusker Army Ammunition Plant.

The Preliminary Pollutant Limit Value (PPLV) method is quantitative and involves the estimation of acceptable intake rates for the site contaminants, definition of exposure pathways applicable to RMA, development of conceptual transport/exposure models for each pathway and mathematical representation of each model, quantification of each model parameter, and computation of contaminant specific numerical criteria, i.e., the soil PPLVs. The acceptable human intake for a given contaminant is computed for carcinogens as the ratio of the risk level to the potency slope (EPA Cancer Assessment Group Value). For non-carcinogens, it is calculated at the ratio of the no-observed-effect-level (NOEL) to a predesignated uncertainty factor. The soil concentration which ensures that transport of a contaminant to humans through any exposure route does not exceed the acceptable intake rate is defined as the PPLV and therefore constitutes a numerical criterion for the contaminant in soil, specific to the pathway of exposure.

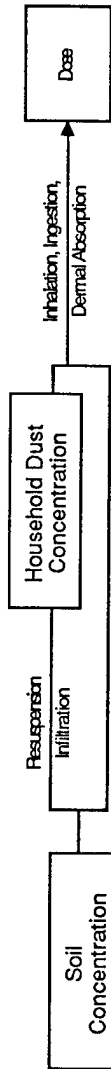
The transport of contaminants within pathway compartments is illustrated conceptually in Figure 2-4 in terms of box models. The conceptual models are then expressed in terms of a mathematical representation which relates the PPLV to the acceptable dose and to the applicable transfer coefficients and pathway specific parameters.



DUSTY AIR INGESTION AND INHALATION



SOIL INGESTION, INHALATION, AND DERMAL ABSORPTION



VAPOR (Enclosed Space)



VAPOR (Open Space)

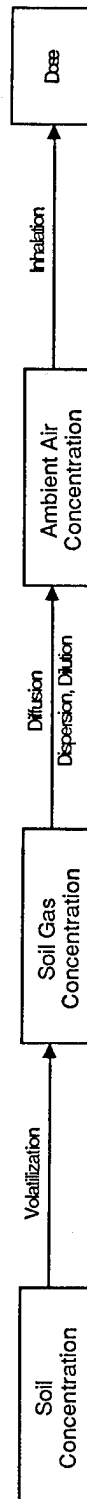


Figure 2-4
PATHWAY MODELS

Prepared for:
U.S. Army Program manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

12/03/87

Numerical soil criteria are computed for the applicable exposure pathways and potential surface use options. Exposure pathways applicable to RMA include soil ingestion, dust inhalation, and vapor inhalation. Designated potential surface uses for RMA are open space, recreational, commercial, and industrial. The manner in which these pathways combine under each surface use element is shown in Figure 2-5. For each surface use, the cumulative pathway PPLV results from the contribution of each single pathway PPLV. The cumulative PPLV value is controlled by the most critical pathway, i.e., the one with the lowest PPLV.

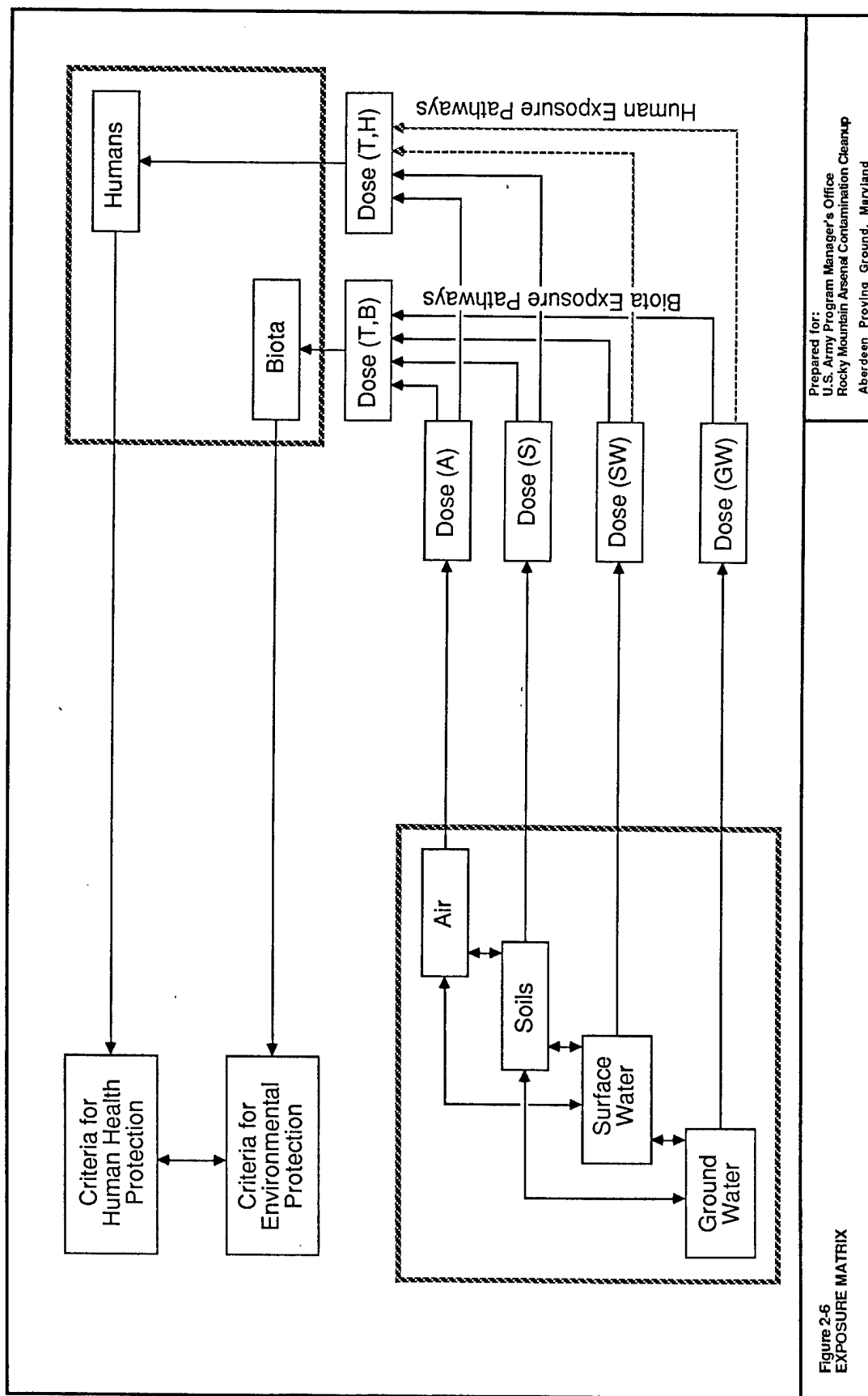
To determine the significance of the measured contamination at a given source or area within RMA as related to human health and environmental protection, concentrations of contaminants in soils measured during the RI program are compared to their cumulative PPLV computed for each of the surface use options. In this manner, the severity of the contamination is inferred and therefore the decision process regarding the development of action levels and response objectives is triggered. The significance and severity of contamination can be determined from a quantitative indicator, the Exposure Index. The Exposure Index is defined as the ratio of the maximum contaminant concentration measured at the site to the applicable surface use PPLV. The significance of the contamination is measured by whether the maximum concentration exceeds the PPLV and the severity is indicated by the magnitude of the exceedence. The frequency of exceedence provides a measure of which contaminants will be driving the cleanup. The spatial distribution of exceedence indicates the extent to which remediation may be required.

In combination, therefore, the RI and EA characterize the contamination in each potential exposure media, the pathways through which contaminants reach the target receptors (humans and biota), the acceptable contaminant dose and equivalent acceptable soil concentration, the significance and severity of contamination in soils and associated transport media, and the designation of areas of both vertical and lateral extent which will necessitate remediation. The interaction of these two program elements leads to an Integrated Endangerment Assessment (IEA) for RMA as shown diagrammatically in Figure 2-6.

SURFACE USE				
SITE PATHWAYS	Open Space	Recreational	Commercial	Industrial
Soil Ingestion	●	●	●	●
Dust Inhalation				●
Vapor Inhalation (Enclosed Space)			●	●
Vapor Inhalation (Open)	●	●	●	●

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 Rocky Mountain Arsenal Contamination Cleanup
 Aberdeen Proving Ground, Maryland

Figure 2-5
 SURFACE USE/EXPOSURE PATHWAY MATRIX



In performing an IEA, it is assumed that contaminants are distributed and equilibrated among all media (air, water, soils). Therefore, the total dose received by both humans and biota reflects a cumulative media dose through all applicable exposure pathways. For humans, the PPLV methodology accounts for the dose received from soils and air. Exposure to surface waters is accounted for indirectly through the vapor pathway. It should be noted, however, that vapor inhalation as addressed in the PPLV methodology applies to both closed conditions (basement air) and to the open environment.

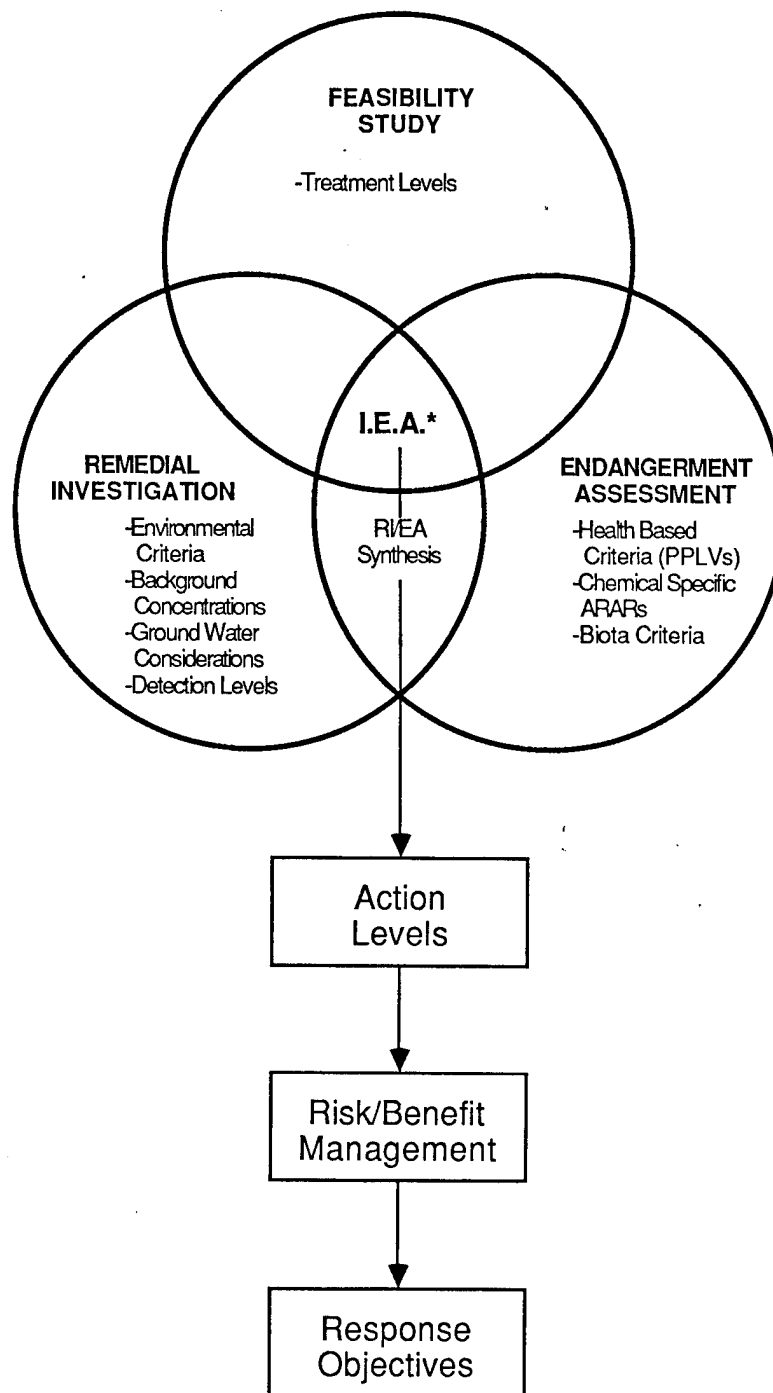
Direct exposure to ground water is not considered in the onpost EA because the Army will continue use restrictions. However, to ensure that the soil PPLVs are protective of both surface and ground water contamination, equivalent soil criteria are calculated and compared with the PPLV and biota criteria.

As part of the EA, elements of the FS are addressed particularly regarding the screening of technologies towards options appropriate to the remediation of critical pathways and contaminants, detection levels, and remedial alternatives that can attain treatment levels compatible with the range of contaminant specific criteria developed under the EA. In addition to the remedial considerations provided above, site restrictions, site conditions, and ARARs (including the potential for human contact) are considered to determine the action level for a site or area. Therefore, action levels may be ARARs, PPLVs, detection limits, background concentrations, or other criteria as deemed appropriate based on health, technology, statutory, or site management requirements. Once action levels are established, the development of response objectives or remedial measures necessary to meet the preset action levels may proceed. The integration of the RI/EA/FS program elements are presented in terms of an interactive and information flow scheme in Figure 2-7.

2.4 FEASIBILITY STUDY

2.4.1 Overview of Process

The purpose of the FS is to select a remedial action alternative for RMA, through a rigorous screening and evaluation process which is protective, cost-effective, and implementable. The FS process that will be used for



*Integrated Endangerment Assessment

Figure 2-7
EA INTERACTIVE FLOW SCHEME

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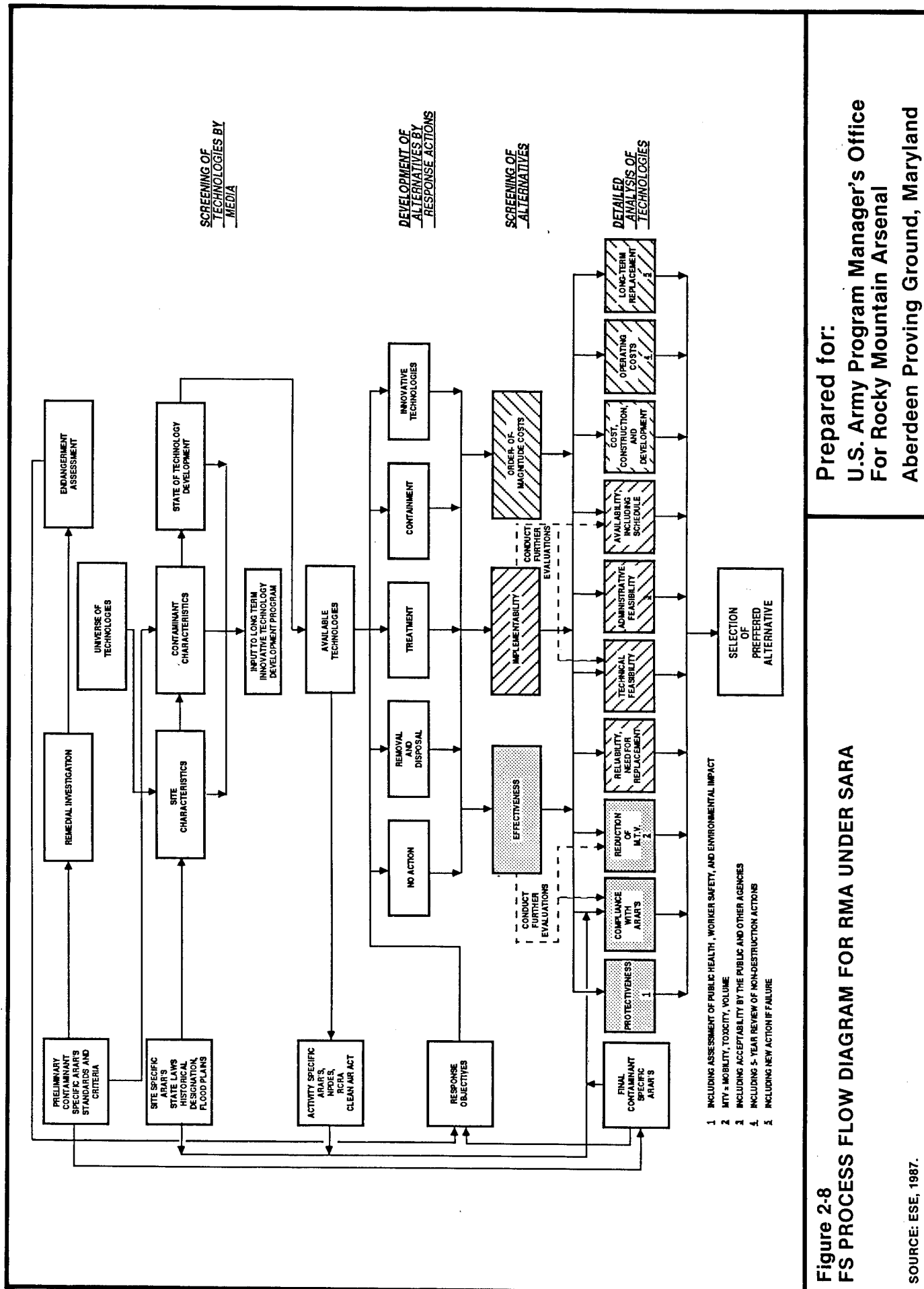
selection of the alternatives for each of the two Operable Units (Onpost and Offpost) will be not inconsistent with the FS process as required under the NCP and with available EPA guidance for conduct of the FS and as revised by Selection of the Remedy Process under the Superfund Amendments and Reauthorization Act (SARA).

Figure 2-8 represents the process that will be used in performing the FS resulting in the selection of a preferred alternative(s). Overall, the process consists of 5 major steps:

- o Identification and screening of a universe of technologies;
- o Development of a set of alternatives that provide a range of remediation;
- o Screening of the set of alternatives to minimize the number that will be evaluated in detail;
- o A detailed analysis of alternatives; and
- o Selection of a preferred alternative and a rationale for its selection.

The process is integrated with and dependent upon inputs from the RI and the EA. The RI will provide data with respect to the type of contaminants, location, and the concentration profiles of these contaminants in the media in which they were found. The EA will provide the pathways by which human or environmental receptors are exposed to the contamination. In addition, where ARARs are not available for specific contaminants in a media, the EA will provide a health-based criteria that will be used as a basis for consideration of an action level. These outputs from the EA will be used in the development of specific response objectives which will set the goals for the alternatives to meet.

Other inputs to the FS process include the determination of the ARARs for the identified contaminants and the site specific ARARs associated with RMA. The action specific ARARs will also be an input to the FS, however these ARARs will be determined for the specific technologies that are considered within the FS.



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Figure 2-8
 FS PROCESS FLOW DIAGRAM FOR RMA UNDER SARA

SOURCE: ESE, 1987.

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2.4.2 Approach

For the purposes of the identification of contamination and the development and implementation of remedial actions, RMA and the surrounding impacted area are being considered as two Operable Units, Onpost and Offpost. The rationale, as described previously, is to expedite the cleanup of the Offpost Media which have a direct impact on local residents and not impede this process because of the complexity and diversity of evaluating the Onpost Operable Unit. The FS process for each Operable Unit will be conducted independently to arrive at a selection of the preferred alternative for that Operable Unit. Since the ROD for the Offpost Operable Unit will be issued prior to the completion of the Onpost FS, consideration of the affect of Onpost actions on Offpost receptors and remedial actions will be a necessary component in the evaluation of Onpost alternatives.

In the FS, technologies will be identified for each of the impacted media within the operable unit. The media considered are soils/sewers, water, biota, buildings, and air. Alternatives for each of the Operable Units will also be developed on an overall operable unit basis for each of the media. In order to address site or area specific contamination problems that involve more than one media, it may be necessary to develop alternatives that are site and not individual media oriented. In all cases, however, the analysis will be conducted in such a way that individual media within a site may be remediated separately from other media within the same site. These media and site-specific actions will then be considered within the context of the Arsenal-wide remedial actions for each media.

2.4.3 Technology Inventory and Screening

2.4.3.1 Technology Inventory

The technology inventory is intended to be a compilation of all the technologies that can be used in the remediation of hazardous waste. This inventory will be obtained from multiple sources including:

- o The published literature;
- o PMO and USATHAMA literature searches and evaluations;
- o Other Organizations and the State; and
- o The EPA SITE program.

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Technologies will be categorized by the response action that it represents (removal and disposal, treatment, innovative technologies, containment, and no-action). Under this categorization, technologies will be further classified by the media in which they are generally applied and by the study area in which they may be applied

2.4.3.2 Technology Screening

The purpose of the technology screening is to develop a list of technologies that, either independently or in combination with other technologies, will provide a reduction in the mobility, toxicity, or volume of the contamination at RMA. This list is developed through a screening process that eliminates technologies that are not compatible with RMA, the contaminants, or will not be satisfactorily or reliably developed at the time remediation may occur.

Three major screening criteria will therefore be considered:

- o Site characteristics;
- o Contaminant characteristics; and
- o State of the technology development.

The screening procedure is sequential following the order of the criteria listed. Technologies that pass through the site screening will be carried forward, those which do not will be included as part of the continuing innovative technologies examination. Likewise, technologies will be screened for compatibility with contaminant characteristics and, finally, remaining technologies will be screened for state of development. A rationale for the elimination of a technology will be provided.

Included with the site characteristics criteria are the following factors:

- o Is the technology not inconsistent with the site specific ARARs? A determination of these ARARs will be required to complete this screening;
- o Do the hydrological or geologic conditions on RMA preclude the application of a technology? Information on the site characteristics will be obtained from the RI; and

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- o Is the size of the impacted area or the volume of material to be remediated not compatible with the size range for which the technology is commonly applied?

Within the contaminant characteristic criteria are the following considerations:

- o Does the technology reduce the mobility, toxicity, or volume of the contaminant? Data on the contaminants will be obtained from the RI;
- o Is the technology generally applied to the media in which the contaminant has been found?

Under the state of the technology development screening are the following factors:

- o Has the technology been developed either commercially or otherwise demonstrated to a degree that it could, with a reasonable level of additional development, be implemented at RMA?
- o Has the technology been applied at other hazardous waste sites effectively or have previous attempts failed?

Since SARA emphasizes the need to consider to the extent possible treatment technologies, especially innovative technologies, emerging technologies which are promising for the contaminants at RMA but are limited in development will be carried through the screening process. They will be included under the innovative technology response action category.

2.4.3.3 Level of Detail

Technologies will be identified at the process level and inventoried at this level within the various technology categories. For example, centrifuges, gravity thickening, belt presses, plate and frame, drying beds, and vacuum filtration are all processes that can be utilized for dewatering materials. Each of these processes, following identification, would then be inventoried under the technology of dewatering.

Similarly, the screening procedure will also be performed at the process level. Processes which remain following the screening will be again inventoried with a technology category. The remaining processes will also be listed by the media in which they are applicable. As appropriate, an additional list will be prepared of the applicability of the processes for specific categories of contaminants. Hence, granular activated carbon treatment will be listed under the water media as well as under the pesticide, volatile organic, semi-volatile organic, and hydrocarbon contaminant media. Where performance data are available for a process, a performance range for contaminants within that category will be provided.

2.4.3.4 Data Needs

As a result of the technology screening process, information gaps on various processes, especially innovative processes, will be identified. Additional literature search and vendor contact will be sufficient to fill these voids. This additional information will assist and be used in the development of alternatives. Knowledge of the list of remaining technologies that may be used in the development of alternatives will be used as a basis to identify and determine the action specific ARARs. As necessary, laboratory or bench-scale treatability studies will be initiated to fill information gaps. A recommendation for potential treatability tests will also be made at this stage.

2.4.4 Alternative Development and Screening

2.4.4.1 Alternative Development

In the FS process, a set of alternatives representing remedial actions for each of the contaminated media for at least five response action categories will be developed. The five response action categories are:

- o No action;
- o Removal and disposal;
- o Treatment;
- o Containment; and
- o Innovative technologies.

At least one alternative will be developed within each of these categories.

Alternatives will be developed to meet the intent of the response objectives. Response objectives which will be developed as part of the FS will provide a specific objective to be met in the remediation of each of the media, sites, or areas on RMA. The response objectives will consider the exposure pathways and risks developed in the EA and available criteria, standards, or limitations contained within the ARARs or health-based criteria. An example of a response objective would be the protection of humans against contact with a soil containing a contaminant above the health-based criteria determined for that pathway.

Alternatives will be developed for each response action by combining the technologies that when grouped will meet the response objective. Contained within each alternative will be the following information:

- o A description of the technologies that comprise the alternative;
- o The volume or area of material that would be remediated by this alternative;
- o Approximate location where the remedial action, disposal, or treatment system would be placed;
- o The ARARs that are associated with the alternative; and
- o A description of how the alternative would be implemented.

All technologies that pass through the technology screening process may not become part of an alternative. The choice of technologies will be based on the grouping of technologies that are associated with the response action category and, when in combination or independent, meet the response objectives. However, as required by SARA and discussed in EPA Interim Guidance, a range of alternatives (from no action to complete treatment eliminating long-term monitoring) will be developed utilizing the available technologies.

2.4.4.2 Alternative Screening

Following the development of alternatives, all alternatives will be screened to reduce the number of alternatives that would be analyzed in detail in the next step of the process. However, in accordance with the NCP, one alternative in each category will remain. The criteria that will be employed in the screen are effectiveness, implementability, and cost. The

screen for each of the criteria is independent of the other criteria and failure to pass one or more screens may not be cause to eliminate an alternative from further consideration.

The effectiveness criteria considers the ability of the alternative to reduce the mobility, toxicity, or volume of the contamination as well as the ability to meet the response objective.

The implementability criteria considers the technical feasibility of utilizing the alternative at RMA. Considered also is the reliability of the alternative to meet the associated performance requirements and the continued control of RMA following remediation.

The cost screen will be used to eliminate alternatives within a category which are at least an order of magnitude more costly than the other alternatives which provide similar results. Cost will not be used to compare alternatives between categories. The degree of cost estimation accuracy for this screen is expected to be within a -50% to +100% range.

Innovative technologies will be carried through the screening process if they offer a potential for better treatment performance or implementability, less cost, or few or less adverse impacts than other available alternatives.

2.4.4.3 Level of Detail

The alternatives that will be developed will be comprised of a string of technologies which when combined will meet response objectives and are consistent with the cleanup strategy that the alternative represents. The objective of the screening is to reduce the number of alternatives comprised of these technologies which will be considered in the detailed analysis of alternatives. In order to evaluate the alternative, it will be necessary to select processes which are representative of the technologies. This will allow consideration of the performance, cost, and implementability of the alternative based on these factors for the representative process selected. Figure 2-9 is an example illustrating the level of detail progressing from the strategy stage, to the technology state, and finally to the process stage.

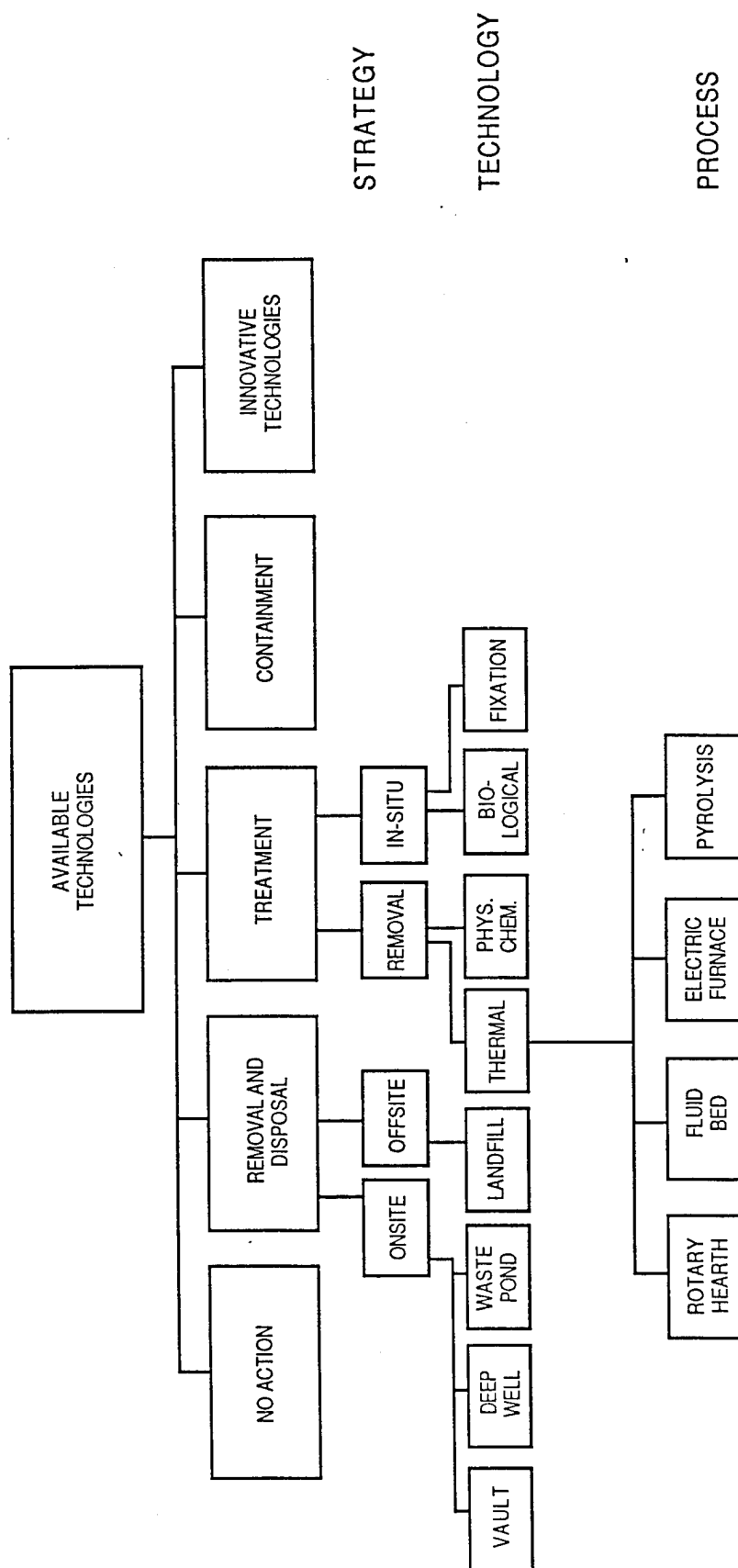


Figure 2-9

SCREENING LEVELS FOR ALTERNATIVES ANALYSIS

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 For Rocky Mountain Arsenal
 Aberdeen Proving Ground, Maryland

Since it is likely that more than one process is representative of a technology, if an alternative is eliminated by one or more of the criteria, the processes chosen will be reconsidered and the alternative reevaluated to prevent the elimination of a viable alternative because of the choice of the representative process.

2.4.4.4 Data Needs

The alternative screening process will identify areas where additional site or technology performance data is required in order to further develop and evaluate alternatives. Data needs that may be identified at this stage may include:

- o Geologic, hydrologic, and physical properties of the soils and water on and around RMA as well as for specific sites;
- o Bench or field treatability studies on specific technologies to demonstrate performance and to prepare more reasonable cost estimates in the detailed analysis of alternatives;
- o Bench or field studies on innovative technologies;
- o Initiation of studies including large scale bench or pilot studies of technologies that would either require extensive lead time to develop, design, or implement; or would be needed to obtain a better understanding of their potential applicability and performance; and
- o Additional site investigation on the contaminant extent, or to perform modeling or other simulation.

2.4.5 Detailed Analysis of Alternatives

A detailed analysis of each alternative that passes through the initial screen will be performed in order to provide the decision-maker with supporting documentation to select the preferred alternative. Each alternative will be evaluated independently for each of the 10 criteria shown in Figure 2-8. These criteria which are described below address all the considerations within EPA 1987 Interim Guidance. Following the analysis of the alternatives against each of the individual criteria, the alternatives will be assessed from the standpoint that they provide protection of human health and the environment.

The criteria that will be evaluated in this analysis are:

- o Protectiveness - This criterion involves a determination of whether the alternative provides the degree of removal or treatment necessary to reduce exposure to or migration of contamination to levels which adequately protect human health and the environment. The ability of the alternative to maintain long term protectiveness, the time required to reach the required level, and the protection afforded workers during remediation are considered.
- o Compliance with ARARs - This factor evaluates the ability of a given alternative to meet the substantive requirements of ARARs. This includes ARARs associated with the contaminants, the site, or the specific activity. In cases where an ARAR will not be met, reasons for such determination, including a technical justification for a waiver, will be provided.
- o Reduction of Mobility, Toxicity, and Volume - Although an alternative may be protective and meets ARARs, SARA further requires an evaluation of the alternative for ability to reduce the toxicity, volume, or mobility of contaminants. This factor reflects the SARA preference for permanent destruction or isolation of contaminants, thus eliminating potential future threats to the environment. Therefore, removal/treatment alternatives are considered preferable to containment, particularly landfilling of untreated, unstabilized materials.
- o Reliability - Factors considered in assessing reliability are the ability of an alternative to deliver and maintain an adequate level of protection. This includes assessment of the potential need for replacement and the consequences of failure of the original action. For example, a slurry wall may initially prevent migration of contaminated ground water, but may deteriorate with time, allowing migration to resume. This could create new exposure and require more complex actions to regain the required level of protection, which must be considered in evaluating the original action.
- o Technical Feasibility - This factor considers the ability of the alternative to be constructed or implemented for the specific site and provide the required level of protection. This includes

evaluation of site or technological limitations that have been identified or should be further considered as possible limitations to performance.

- o Administrative Feasibility - Administrative factors may operate to increase significantly the cost of a certain potential remedy or the ease or speed by which it can be implemented. For example, whether an otherwise convenient offsite waste facility warranted consideration as a possible waste disposal location would largely depend on whether it was permitted to receive such waste by the proper EPA or State authority.
- o Availability and Schedule - Although an alternative may meet all other criteria, the system size or required level of development may limit availability. The time required to design and construct suitable equipment will be compared against the time required to remediate using existing equipment. For example, large scale incineration systems capable of processing contaminated soils from RMA do not currently exist. The time required to remediate the site using existing equipment will be evaluated against the time required to design, construct, and remediate with larger units built specifically for RMA.
- o Cost, Construction and Developmental - Capital cost will be developed on a unit cost basis considering all elements of the alternative. Investigative, developmental, or design costs necessary to implement the alternative will be considered. In accordance with SARA, capital costs will also include the first 10 years of operating and maintenance costs.
- o Operating Costs - This factor will include all labor, materials, and utility costs necessary to operate the system and maintain the desired level of protection. Operation and maintenance includes the replacement costs for materials with a limited lifetime. Also included is the cost for monitoring and/or reinvestigating areas where complete removal or destruction is not performed, to see if additional future actions are required. Present worth will be calculated for a 30 year period reflecting both capital and operating costs.

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- o Long-Term Replacement - In cases where complete removal or destruction is not provided, replacement of containment systems may be required following failure or at the end of the systems design life. Capital and operating costs for such replacement will be included in evaluation of the original system.

2.4.5.1 Level of Detail

The alternatives analysis will evaluate alternatives as a composite group of technologies and not be individual technologies or processes. However, in order to determine the protectiveness and cost of an alternative it will be necessary to compute and calculate performance and cost data by technology. The overall cost of the alternative will be a summation of the individual technologies. Furthermore, a process representative of the technology will be utilized to calculate this information. As previously stated, if an alternative is to be eliminated because of cost or performance, then the processes which were chosen would be reevaluated and a reevaluation would be performed using a different process.

2.4.5.2 Data Needs

From the alternatives analysis, additional data needs will be identified to complete the analysis and to support the selection of a preferred alternative. These data needs will be similar to those identified at the end of the Screening of Alternatives, however the focus will be specific to addressing specific alternatives and the scope of the resulting efforts may be significantly larger. Specific needs which will be identified during or at completion of the Detailed Analysis of Alternatives will be pilot studies and modeling.

2.4.5.3 Pilot Studies

Pilot studies which may be conducted in support or as a result of the Detailed Analysis of Alternatives may include various treatability studies to determine the effectiveness of various technologies within an alternative or to develop design criteria necessary to cost the alternative. The pilot studies could be of a bench or field scale depending upon the need and the

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type of technology. Pilot studies may also be conducted to demonstrate the performance of an innovative technology or to demonstrate that an ARAR could be met by an alternative.

2.4.5.4 Modeling

Modeling will be a necessary component in the evaluation of alternatives and in the design of remedial systems. Because RMA is an extremely large and complex site and contamination on RMA is contributing to offpost contamination, a regional hydrologic and contaminant transport model will aid in determining the effectiveness of various alternatives in the control or mitigation of the contamination. Likewise to determine the influence of and evaluate alternatives for remediation of specific site problems, additional localized models will be of interest.

The three major objectives of any modeling efforts will be :

- o Obtain an understanding of the hydrologic, geologic, and natural processes affecting flow and contaminant transport;
- o Predict or estimate the effect of various remedial systems; and
- o Optimize the remedial action design, siting, and costing.

The approach to be used in modeling consists of the following:

- o Identify the specific needs of the program answerable through modeling;
- o Set specific objectives and the desired results of the modeling;
- o Determine the specific needs for regional and site models;
- o Evaluate available published models for regional and site applications;
- o Select various models and modeling teams to conduct the program;
- o Review and compile necessary data sets to run the model; and
- o Run and assess models with respect to objectives and anticipated results.

2.4.6 Selection of the Preferred Alternative

The selection of the preferred alternative by the decision-maker will be

done in accordance with the requirements set forth in the NCP and SARA. EPA 1987 Guidance for the selection of the remedy proposes that the selected remedy meet the following criteria:

- o Provide protection of human health and the environment;
- o Attain ARARs;
- o Be cost-effective; and
- o Utilize permanent remedies, innovative technologies, or resource recovery to the maximum extent possible.

The FS will summarize and compare the alternatives with respect to the above criteria and provide supporting documentation as appropriate to provide the decision-maker with a basis to make a selection.

3.0 INTERIM RESPONSE ACTIONS

3.1 OVERVIEW

The IRA facet of the RMA environmental program involves initiating selected response actions prior to a decision on final remediation at RMA. The Army, in cooperation with the EPA, the State, and Shell, originally identified 14 specific IRAs that are considered necessary and appropriate to achieve in advance of the ROD process for the Onpost and Offpost Operable Units. The IRA process is consistent with CERCLA and SARA, and the IRAs themselves are to be consistent with and contribute to the efficient performance of the Final Response Actions for the Onpost and Offpost Operable Units. The currently planned IRAs are as follows:

- o Treatment System for South Adams County Water and Sanitation District (SACWSD);
- o Hookup of Private Wells to SACWSD System;
- o Ground Water Intercept and Treatment System North of RMA;
- o Boundary System Evaluations and Improvements;
- o Ground Water Intercept and Treatment System North of Basin F;
- o Abandoned Well Closure;
- o Ground Water Intercept and Treatment System in the Basin A Neck Area;
- o Basin F Liquids, Sludges, and Soil Remediation;
- o Building 1727 Sump liquid Remediation;
- o Hydrazine Facility Remediation;
- o Fugitive Dust Control;
- o Sanitary Sewer Remediation;
- o Asbestos Removal; and
- o Other "Hot Spot" Contamination Source Remediation.

The IRAs listed above are governed solely by the process set forth in Section XI of the RMA Consent Decree. The IRA implementation sequence will normally proceed in the following manner:

- o Identification of the Proposed IRA;
- o Evaluation;
- o ARAR Determination;
- o Assessment;
- o Decision Document;
- o Criteria Development/Design; and
- o Implementation/Construction.

The basic IRA process is shown diagrammatically in Figure 3-1. Since the IRA process does not identify all timeframes for the various steps in the IRA process, approximate times have been assumed for the purpose of this plan. While the review times in the IRA process can be established with some sense of certainty, it should be noted the time required for conducting an IRA assessment is highly variable, depending on the nature of the IRA. The assessment period of performance can be determined with greater reliability at the time the scope-of-work for the assessment is prepared.

The mechanism for carrying out the assessment and, ultimately, the implementation and construction of the IRAs is through contractual arrangements with independent architecture/engineering firms. Organizations that will be involved in contracting for such services include the PMO-RMA, the Army Corps of Engineers, USATHAMA, and Shell.

Constraints and assumptions which currently apply to this IRA Implementation Plan and schedule include the following:

- o It is currently assumed that the Army will be the Lead Agency for all Interim Actions, except where Shell is specifically identified as the Lead Agency (i.e., Basin F storage tanks and North Boundary System Recharge Trench) and where EPA Region VIII is the Lead Agency for the SACWSD interim action;
- o Adequate resources (i.e., funding, contracts, and personnel) will be available; and
- o Schedules assume no dispute resolution will be sought.

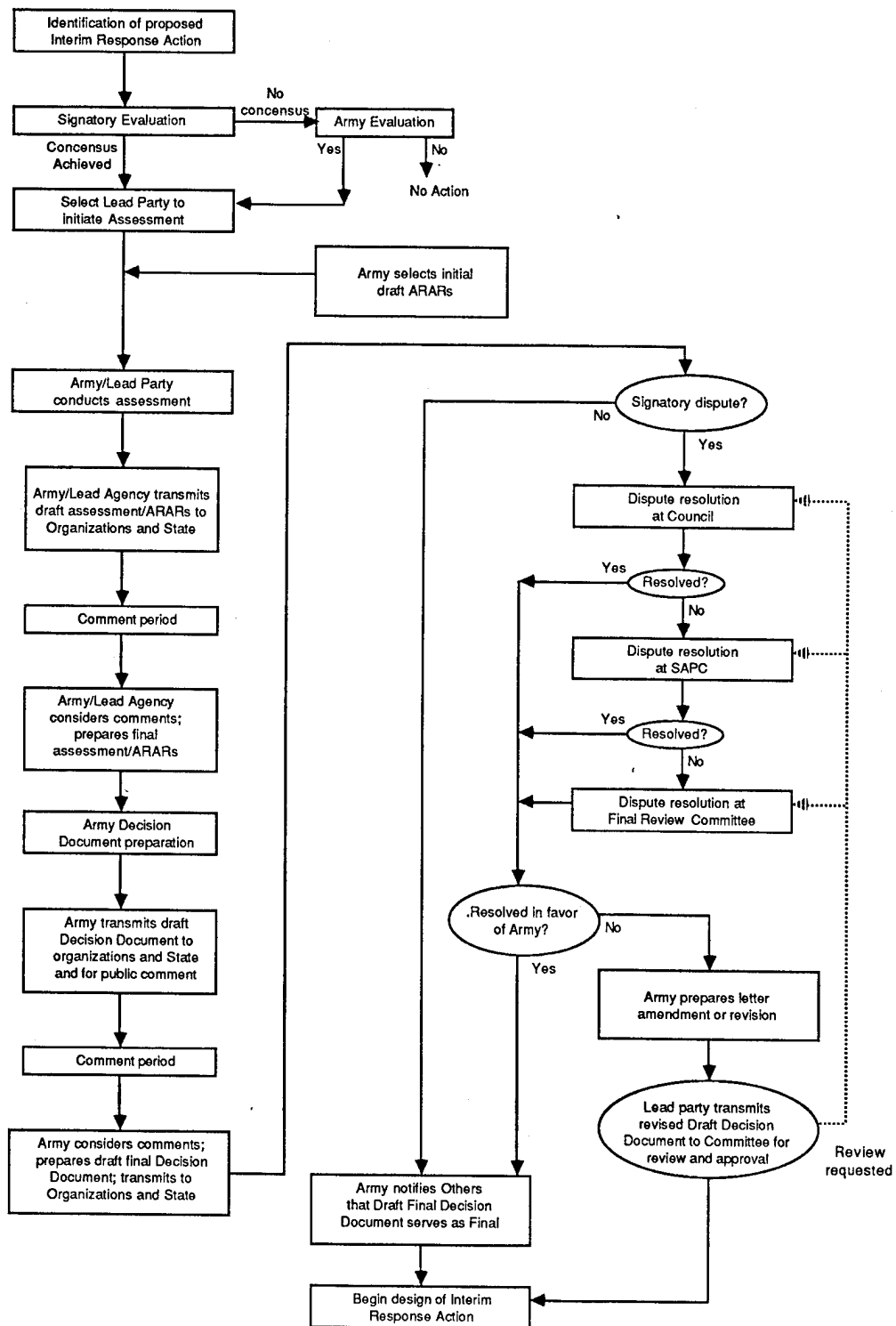


Figure 3-1
INTERIM RESPONSE ACTION PROCESS

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U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

3.2 INTERFACE WITH RI/EA/FS

As mentioned previously, IRAs are to be consistent with and contribute to the efficient performance of the Final Response Actions for the onpost and offpost Operable Units. Additionally, if the IRA will not fully address the threat posed by a release and further response is required, there must be a transition from the IRA to the Final Response Action. In order to ensure the accomplishment of the above requirements, information exchange between the RI/EA/FS and the IRA is essential.

The PMO-RMA will serve as the means for ensuring that IRAs make maximum use of existing RI and EA data, and that the FS element is aware of the status of the IRAs and any data generated that may be of use to the FS. While the IRAs have separate assessment activities which may parallel RI/EA/FS efforts, every effort will be made to avoid duplication of work between Interim and Final Response Action activities.

3.3 IRA DESCRIPTIONS

The IRAs discussed in the following sections incorporate the assumptions and constraints previously mentioned, as well as an interpretation of the latest information available on the IRA process language of the forthcoming Consent Decree. Milestones presented in Chapter 7 are best estimates, given the data currently available.

3.3.1 Ground Water

3.3.1.1 Treatment System for SACWSD and Hookup of Private Wells to SACWSD System

- Objective

To minimize the exposure of SACWSD residents to trichloroethylene that has been detected in their drinking water source.

- Description

This IRA consists of the United States providing certain funding, pursuant to an appropriate agreement with the State and with SACWSD, for the continued operation of the temporary water treatment system currently being used by SACWSD; the design, construction, and operation of a permanent water

treatment system for SACWSD; and the hookup of private wells to the SACWSD system, at each owner's option, in an area north of 80th Avenue and west of RMA. This action was turned over to the SACWSD following the signing of an agreement with the Army, EPA, the State, and SACWSD on October 30, 1987. It will not be subject to the provisions of the Technical Program Plan.

3.3.1.2 Ground Water Intercept System North of RMA

- Objective

Minimize the risk of future exposure from contaminated ground water plumes north of RMA.

- Description

This IRA consists of the assessment, selection, and implementation, as necessary, of one or more ground water intercept and treatment systems north of RMA. One candidate location for such a system is the First Creek/Highway 2 area. Task 39 will provide information to assess and select an appropriate location and type of system. The design and construction of a system, if necessary, will be accomplished through the Omaha District Corps of Engineers.

3.3.1.3 Boundary System Evaluations and Improvements

- Objective

Evaluate and improve, as necessary, all RMA boundary systems.

- Description

This IRA consists of the assessment of the need for improvements (such as expansion to the NBCS and of the selection and implementation of any appropriate improvement, as necessary); the assessment of the other two boundary systems (Irondale and NWBCS) on RMA and the selection and implementation of any appropriate improvements to these systems, as necessary; and the construction of ground water recharge trenches to increase the rate of reinjection of treated ground water at the NBCS.

Evaluation of the NBCS will be accomplished through Task 36, Task 25, and the Annual Operation Assessment. The NWBCS will be evaluated using this Annual Operational Assessment. Shell will evaluate their Irondale Boundary System. Improvements will be implemented as required. The NBCS recharge trench will be implemented by Shell in an arrangement similar to that used for the Basin F storage tanks.

3.3.1.4 Ground Water Intercept and Treatment System North of Basin F

- Objective

Treat contaminated ground water emanating from the Basin F area.

- Description

This IRA consists of the assessment and selection of a ground water intercept and treatment system north of Basin F and the implementation of such a system, as necessary. The Omaha District COE has been tasked to conduct the assessment and, as required, the design and construction of the system.

3.3.1.5 Closure of Abandoned Wells on RMA

- Objective

Identify, locate, examine, and properly close old or unused wells on RMA to prevent migration of contamination from upper to lower aquifers.

- Description

This IRA consists of plugging and closing candidate wells initially identified through Tasks 4 and 44 and the Comprehensive Monitoring Program. The Abandoned Well Interim Action has been initiated under Task 37. Wells located within the Task 37 study area will be prioritized for field searching, examination, and selective sampling. After completion of the Task 37 effort in late FY88, the second phase of the Abandoned Well Interim Action will begin. This phase will include closing all remaining candidate wells, as identified through the Comprehensive Monitoring Program. Criteria and procedures similar to those used in the Task 37

effort will be used during the second phase. Completion of the second phase is estimated by the end of FY89.

3.3.1.6 Basin A-Neck Ground Water Intercept and Treatment System

- Objective

Treat contaminated ground water in the alluvial aquifer between Basin A and Basin F.

- Description

This IRA consists of the design and construction of an alluvial ground water intercept and treatment system in the Basin A-Neck area on RMA. Utilizing the Task 26 assessment along with other pertinent information that may be provided by the MOA parties, the best location of the system will be identified. The treatment concept assessment will be performed under a new contract currently scheduled for award in the 3rd Qtr FY88. Subsequent design and construction will be tasked to the Omaha District, COE.

3.3.2 Soils and Other Contamination Sources

3.3.2.1 Basin F Liquids, Sludges, and Soils Remediation

- Objectives

Abate potential infiltration of contaminants to the ground water, preclude volatile emissions, and mitigate the impact of Basin F on wildlife.

- Description

This IRA consists of the remediation of contaminated liquids, sludges, and soils from and under Basin F. Once liquids are removed to temporary storage tanks (constructed by Shell pursuant to a Memorandum of Understanding with the Army), the soils and sludges remaining in the basin and those down to a specified depth beneath the basin liner will be solidified, as necessary, and transported to a temporary storage area within the basin. Final treatment and disposal of the liquids, sludges, and soils will then be handled as part of the final remedial action for RMA. Work is expected to begin April 1988 after issuance of the Final Decision Document.

The second phase of this IRA will investigate treatment/disposal (and temporary storage, if appropriate) of the Basin F liquids due to the probability that implementation of the final remedial action for RMA may exceed the service life of the storage tank.

The first step for this expanded IRA involves the completion of a screening of technologies for their applicability to remediation of the Basin F liquid. This work is being completed by the Technology Division of the U.S. Army Toxic and Hazardous Materials Agency and is discussed in Section 4.5. Those technologies that pass through the screening process will then be used in the Development, Screening, and Evaluation of Alternatives which will be conducted under IRA2 of the new PMO contract, as discussed in Section 4.2. After completion of the alternative evaluation step, it is anticipated that an alternative will be selected for the expanded Basin F IRA and an IRA Decision Document (IRADD) will be prepared. Review and coordination of this IRADD will be consistent with other IRAs currently ongoing.

3.3.2.2 Building 1727 Sump

- Objective

Prevent the overflow of contaminated liquids from the sump and mitigate remaining threat of releases.

- Description

This IRA consists of temporary storage and treatment of contaminated liquid from the sump to prevent a release of contaminants while the Task 30 assessment is in progress. Pilot-scale treatment systems have been tested under Task 30 to evaluate alternative processes for remediation of contaminated liquid in the sump. The final assessment will determine what actions need to be implemented to eliminate any remaining threat of releases in the future.

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3.3.2.3 Hydrazine Blending and Storage Facility (HBSF) Remediation

- Objective

Mitigate the threat of releases of wastewater stored at the HBSF and remediate the above ground structures.

- Description

This IRA consists of the treatment and disposal of pretreated liquids in tanks used for storage of waste products from the blending of rocket fuels and the dismantling and disposal of all remaining aboveground structures associated with the Hydrazine Facility.

Extensive use will be made of the Task 34 Assessment Report, and the implementation will be performed by the Omaha District, COE.

3.3.2.4 Fugitive Dust Control

- Objective

Safeguard against the generation of windblown contaminated dust.

- Description

Unvegetated areas in Sections 26 and 36 are the two primary areas which are likely sources of contaminated windblown dust. Application of dust suppressants in or around Basins C and F in Section 26 are not advisable at this time, since the Basin F interim response action is in progress. Application of dust suppressants to unvegetated areas of Basin A is warranted and is planned to begin December 1987. A natural humate organic binder, applied in 1984 around Basin F, is the planned dust suppressant for this IRA. The application rate of the dust suppressant concentrate will increase from 807 gallons per acre in 1984 around Basin F to 1,200 gallons per acre in Basin A, due to the lower clay content of the Basin A soil.

3.3.2.5 Sanitary Sewer Remediation

- Objective
Eliminate potential conduits for flow of contaminants to ground water.
- Description
The Sanitary Sewer System Interim Action will involve prioritizing different sewer system segments as candidates for plugging or removal. The result of Task 10 (Sewer System Remedial Investigation) will be the basis for the prioritizing effort. All plans for sewer segment plugging or removal will be coordinated with RMA plans for maintenance, improvement, and replacement of the affected sewer system segments.

3.3.2.6 Asbestos Removal

- Objective
Remove and dispose of friable asbestos on RMA where the potential for human exposure exists.
- Description
This IRA consists of an assessment to identify candidate locations and the subsequent removal and disposal of all friable asbestos. Information from Task 24 (Buildings Remedial Investigation) and the RMA Asbestos Abatement Program will be the basis for selecting appropriate sources for remediation.

3.3.2.7 Remediation of Other Contamination Sources

- Objective
Mitigate the threat of releases from selected "hot spot" contamination sources.
- Description
This IRA consists of the assessment, selection, and implementation, as necessary, of interim response actions for the Section 36 Trenches, the Section 36 Lime Pits, the M-1

Settling Basins, the Motorpool Area, the Railroad Holding Track, and, where appropriate, the placement of such material in a properly constructed temporary storage area or areas on RMA.

4.0 RELATED EFFORTS

4.1 COMPREHENSIVE MONITORING PROGRAM

Several tasks under the existing RI/FS task order contract have the objectives of performing remedial investigations to determine the nature and extent of contamination in ground water, surface water, air, and biota.

These tasks are as follows:

- Task 4: Ground Water/Surface Water Quantity/Quality
- Task 9: Biota Assessment
- Task 18: Air Monitoring
- Task 25: North and Northwest Boundary Control System Monitoring
- Task 36: Evaluation of North Boundary Containment System
- Task 39: Offpost RI/FS
- Task 44: Ground Water/Surface Water Contamination Assessment

These tasks are currently funded through the existing RI/FS contract which is scheduled for completion in 1988. Verification monitoring of ground water, surface water, air, and biota will continue under a new contract entitled "Rocky Mountain Arsenal Comprehensive Monitoring Program" (CMP).

The CMP was awarded to R.L. Stollar and Associates, Inc. on September 23, 1987. The objective of the CMP is to conduct a comprehensive long-term monitoring program at RMA to maintain baseline monitoring data and to verify changes in these media over time. Although not part of the RI program, the CMP may input relevant data directly into the ongoing FS process. The monitoring program consists of the following:

- o Ground water hydrology and water quality monitoring to substantively meet regulatory and compliance requirements, including the verification of ground water migration pathways and identification of long-term changes in contamination plumes;
- o Surface water monitoring to verify surface water contamination migration pathways and the collection of water quantity data to verify the water balance developed under the RI/FS program;
- o Ambient air monitoring to verify baseline air quality data and provide guidance to operations monitoring programs during execution of RMA remedial actions;

- o Biota monitoring to verify the long-term effects of chemical contamination on plant and animal populations of the RMA regional ecosystem;
- o Integration and verification of the ground water, surface water, ambient air, and biota monitoring data. The interpretation shall be available to support future remedial action (cleanup) and litigation efforts; and
- o Replacement and repair of monitoring wells, surface water, and air monitoring devices as required to maintain the monitoring program or enhance the understanding of known or suspected chemical contamination.

4.2 NEW TASK ORDER RI/FS/IRA CONTRACT

The budgets and schedules for tasks under the current RI/FS contracts are insufficient to allow collection and interpretation of all information necessary to select remedial actions and prepare a ROD. The CMP will provide for verification data collection and will determine performance of implemented interim action systems. However, neither the current RI/FS task order contracts nor the CMP provide mechanisms to complete the SARs, the EA, and the FS, or to complete evaluation of preferred or innovative technologies. Additionally, there are support tasks to these efforts which are not currently funded. These tasks include modeling to assess impacts of remedial technologies, development of a conceptual design for the remediation, and support to prepare and provide data for regulatory purposes. Therefore, the PMO-RMA is currently preparing scopes-of-work for follow-on contracts to provide for the completion of the RI/FS and the preparation of the RODs, as well as to finalize evaluation and selection of the design criteria for the technologies within the selected alternative.

Based on current schedules and task budgets, Task 35 will carry the EA through the contaminant specific ARAR determination, and into preliminary work for the exposure assessment. Task 28, because of a limited budget and a schedule which is dependent upon the completion of the SARs, ARAR determinations, and the EA, will only be capable of carrying the process through the screening of technologies. Development of alternatives for selected study areas may also be possible if the SARs and the EA for these

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areas are sufficiently complete to allow the preparation of responsive objects for those areas. Based on these assumptions, the following are potential tasks that the follow-on contracts will address:

- o RIFS1--RI/EA (Biota, water, SARs, ExpA). This task completes all RI programs and the Exposure Assessment of the EA Program, including completion of the regional biota and water programs, completion of all SARs, and completion of specific media reports.
- o RIFS2--FS-Development and Screening of Alternatives. This task also includes all efforts to finalize the Offpost Programs.
- o RIFS3--FS-Modeling/Treatability Studies. This task includes modeling to assist in the evaluation of various alternatives and in the siting of remediation systems, performance of pilot studies to demonstrate technologies, develop performance and cost data, and initiate design criteria development.
- o RIFS4--RI Summary Document.
- o RIFS5--Risk Characterization/Endangerment Assessment. This task completes the EA.
- o RIFS6--FS Evaluation of Alternatives.
- o RIFS7--FS Summary Document. This task includes finalization of ARARs and completion of all FS documentation.
- o RIFS8--RI/FS through ROD. This task completes the RI/FS process through and including the ROD. It includes preparation of the RI/FS Summary Document; community relations efforts in the presentation of the RI/FS and ROD to the public; assistance in preparation, staffing, and response to comments on the ROD.
- o IRA1--Basin A-Neck Ground Water Treatment Design. This task will assess system design alternatives, complete any remaining hydrogeologic assessments, conduct pilot testing as required, and develop a complete final design package of the selected system.
- o IRA2--Basin F Liquid Disposal Design. This task will develop, screen, and evaluate alternatives for Basin F liquid treatment, storage, and/or disposal, conduct testing as required, and develop a final design for the alternative selected in the IRA decision Document.

- o IRA3--RMA Abandoned Well Closure. This task will be a follow-on effort to the Task 37 Abandoned Well Closure IRA and will complete the balance of well closure activities.
- o Conceptual Design--This contract also supports the first steps of conceptual design of the preferred alternatives presented in the ROD. It also includes engineering studies to support concept design, regulatory documentation, scheduling, and additional sampling analysis, if necessary, to provide data to support design implementation.

In concert with and following issuance of the ROD, additional contract support will be necessary to prepare the final design plans and specifications for the selected alternatives. Among these tasks are:

- o Collection of data to respond to additional questions raised during the comment period;
- o Collection of data and engineering studies to finalize design and siting criteria;
- o Additional pilot testing to develop process design criteria;
- o Modeling to size and site remediation systems;
- o Data collection and engineering studies for regulatory documentation;
- o Development of design packages and specifications;
- o Development of monitoring programs;
- o Community relations support throughout the design phase; and
- o Preparation of health and safety plans for use during the remedial implementation.

4.3 SHELL BIOTA PROGRAM

Discussion to be provided by Shell/MKE.

4.4 SHELL SEWERS PROGRAM

Discussion to be provided by Shell/MKE.

4.5 ADVANCED TECHNOLOGY PILOT TESTING AND FUTURE EFFORTS

The Technology Division of the USATHAMA is currently supporting the RMA FS Program by completing a Technology Inventory and Screening for Basin F

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liquids and sludges, and the laboratory testing of some of the technologies passing through the screening process. This work was completed as part of Task 8 (TED8) on a Technology Division Contract. Technologies that were selected for laboratory testing included: glassification, soil washing, and circulating bed combustion (CBC). Due to permitting problems with the CBC testing facility, only glassification and soil washing were actually tested.

As a follow-on action to TED8, Technology Division will complete a Technology Inventory and Screening for Basin F "liquids only". This effort, being conducted under Task 12 (TED12) of the Technology Division, became necessary to support the expanded Basin F Interim Response Action as discussed in Section 3.0. As part of this action, Technology Division will develop an inventory list of technologies that are applicable to Basin F liquid only and screen them for inclusion in the Alternatives Development which will be conducted under IRA2 of the New Contract (see Section 4.2). Technology Division may also be involved in testing technologies that pass the screening process, if it is required.

4.6 INNOVATIVE LONG-TERM TECHNOLOGY DEVELOPMENT

If a technology is screened from the FS process because it has not been developed sufficiently, the technology will continue to be considered as part of a long-term Innovative Technology Development (ITD) program. By its inclusion in this program, the technology's state of development will be tracked. If it becomes a viable, proven technology, it may be considered during the FS process or after the ROD, if the benefits are high enough to support reopening the ROD. The ITD program will consist of additional literature searches and laboratory/bench/pilot tests needed to determine the implementability and effectiveness of technologies in the program.

5.0 RELATED EFFORTS NOT SUBJECT TO RI/FS PLAN PROCESS

5.1 EPA OFFPOST EFFORTS

Discussion to be provided by EPA Region VIII/CDM.

5.2 SHELL LITIGATION EFFORTS

Discussion to be provided by Shell/HRO.

5.3 RMA CONTINUING OPERATIONS

The operations and maintenance, along with some limited monitoring, of the RMA Boundary Control Systems (North and Northwest) and Treatment Plants (Sanitary Wastewater and South Plants Laboratory) are performed by RMA personnel under the direction of the Program Manager's Staff Office (PMSO). The following describes the functions that are performed and the parties that are responsible for their completion.

The day-to-day operation of the Boundary Systems and Treatment Plants are the responsibility of the RMA Systems Operations Division. This organization provides the water treatment plant operators to run the plants in accordance with approved Standard Operating Procedures under the supervision of an onsite engineer who reports to the Chief of Operations. The Chief of the Operations Division also has an engineering group to provide engineering to evaluate plant process operations and recommend improvements to the plant as well as collecting, recording of daily, weekly, monthly, quarterly, and annual plant data concerning influent and effluent water flow rates, carbon and chemical usage, and water quality process data. All of this process data together with plant downtime information is compiled and used in the periodic reports concerning plant operations. The data are provided to the RIC Center for storage and use in the preparation of various reports.

The maintenance of the RMA water treatment plants is conducted by either in-house RMA Maintenance Division personnel or by outside contractors. The onsite plant engineer requests the necessary day-to-day repair and replacement work through the RMA Maintenance Division. Work that is out-of-

scope of the onsite RMA maintenance capabilities or manpower, for example cleaning of wells and repairs of pumps and motors, is contracted out.

Materials necessary to maintain the plants are obtained through the services of the RMA Supply Division and the Contracting Office. Major items requiring periodic replacement such as activated carbon are obtained under annual contracts.

Water quality data for the plants is obtained through the in-house RMA Laboratory Division as well as through contract laboratories. The analyses are conducted in accordance with provisions of all applicable laws and regulations. The collected data are provided to the RIC Center for storage and use. The water quality monitoring data are used by the RMA Systems Operations Division to control and ensure that the water treatment plants are in compliance with applicable laws and regulations.

The treatment plant monitoring program for the NBCS, NWBCS, and Sanitary Waste Treatment Plant includes collection of flow information on a daily basis and water quality information on a weekly basis. Influent samples from each of the carbon adsorbers, as well as effluent samples, are regularly collected, and are used in assessing plant performance and determining when carbon changes are needed. The South Plants Laboratory Waste

Treatment Plant is monitored on a monthly basis at the influent and effluent to the carbon and activated alumina columns. Analyses are performed using GS/MS techniques. Monthly GC/MS scans are also conducted on the influent and effluent of the Sanitary Waste Treatment Plant. Other monitoring conducted to comply with the NPDES permit requirements for the Sanitary Waste Treatment Plant includes flow, 5-day Biochemical Oxygen Demand, Total Suspended Solids, Oil and Grease, Fecal Coliforms, and pH.

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6.0 TECHNICAL PROGRAM PLAN MEETINGS

6.1 INTRODUCTION

Over the period from July 27 through September 4, 1987 a series of meetings was held in which the Army explained in detail the basis for the programs now being conducted and planned at RMA. In addition, Shell briefed several of their RI-related activities. The purpose of the meetings was to achieve a consensus on the conduct of these programs. Meeting attendees included representatives from the PMO-RMA, Shell, EPA Region VIII, and the State. Beginning with the ROD and working backward through the FS, the IRAs, the EA, and the RI, each program at RMA was presented and discussed. There was general concurrence with the major features of the program as it is now being implemented, as evidenced by the fact that none of the parties expressed a need for major new tasks or a desire to eliminate ongoing tasks. A number of topics were given particular attention due either to their importance or to evidence of disagreement in past meetings among the parties concerning that particular aspect of the program. At the end of the discussion for each major program element, a summary of the various parties' positions was prepared. This summary is recreated below, along with a discussion describing the consensus position that was achieved for each of these topics.

6.2 POSITION SUMMARY

It is clear that the parties' positions relative to each of the complex technical issues discussed throughout the meetings cannot be fully described in a few words. Nevertheless, Table 6-1 provides a very brief synopsis of the preliminary views of the meeting participants. This table is not intended to represent the final positions of the participating agencies, nor can it contain all facets of each parties' views on these topics. Rather, this table is intended as an aid to help focus future discussions. As such, it brings forth key concerns and suggests possible approaches toward reaching a consensus. In some cases, there are ongoing efforts to more fully explain the rationale for the selection of the approach that the Army is now employing, and as a result there may be some shifts in positions of

Table 6-1. Position Summary (Page 1 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
Record of Decision:				
1. Number of RODs	2 - 1 offpost; 1 onpost	Media-oriented; multiple	Multiple - early off-post ground water; media-oriented onpost as appropriate	Minimize - 1-2 probable (depends upon integration)
2. Level of Detail	Selection at "technology" level; one step lower if necessary	Generally equivalent levels; process level	Same as Army - possible pilot studies	Same as Army plus more pilot studies
3. Staffing	Consistent with requirements of RI/FS Process	-	EPA reviews ROD	-
Feasibility Study:				
1. Approach	Functional equivalent to NCP	Follow NCP exactly; ARARs necessary first	Functional equivalence with EPA/NCP guidance; ARAR determination is iterative	Functional equivalence with NCP with improvements
2. Task 28 Approach	EPA Guidance - multiple input from other tasks	Follows NCP guidance but implementation not consistent (must complete review)	Follows NCP (must complete review)	Agree with basic approach; needs fine tuning
3. Technology List	120 Technologies in "universe"	Need air media (must complete review)	Appears complete (must complete review)	Additions to list; need better definition of terms

Table 6-1. Position Summary (Page 2 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
4. Gross Technology	Follows 3 criteria cited by EPA guidance	Need clean-up goals and response objectives; emphasize permanent MTV reductions	Acceptable - consider new technologies; media-specific	Screen new technologies; consider preliminary action levels/ranges
5. Modelling	Army lead proposed - Regional - Area - Site	Same as Army- considering option of GeoTrans lead	Same as Army- considering option of CDM lead	Same as Army- No preference for lead
Endangerment Assessment:				
1. Approach	Will follow EPA/NCP guidance	Concur	Concur	Generally concur
2. Task 35 Approach	Is consistent with EPA guidance	Disagree; current written plan proposal is inconsistent with NCP; need revised plan	Appears to follow EPA guidance (must complete review)	Appears to satisfy NCP, with modifications (CAG estimates and upper bounds are concern); needs schedules on toxicity profiles and kd
3. Integrated Endangerment Assessment	Approach addresses criteria from other tasks	Disagree; onpost pathways must be revised; awaiting written plan	Concur, but need to resolve ground water pathway	Concur
4. PPLV for Soils	Plan to use approach; willing to consider changes in k's and assumptions	Conceptually OK; needs modification or alternative method	Concur, but need all party review of implementation, assumptions, etc.	Model could be appropriate, but k's and assumptions need work
5. Exposure Controls Use?/When?	Yes/Determine early in RI/FS	No controls during evaluation/ROD	Position pending	Yes/Doesn't matter, but shorten process if possible

Table 6-1. Position Summary (Page 3 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
6. Timing of Release of PPLVs	Within the Exposure Assessment	As a package in proper context; legal determination (FOIA/CORA)	Draft; as package (with supporting analysis & interpretation); needs legal review	After EA is substantially complete
7. Definition of IEA Goal of "Prevent Migration of Contamination"	Long-term goal; short term can permit changes in ground water concentration	Long term goals shouldn't preclude specific remedial actions	Goal, but should not preclude evaluation of remedial alternatives	Short term increases to ground water concentrations permitted; word Response Objectives carefully
8. Stepwise Approach to Exposure/Toxicity Assessment	Willing - SAR basis	Currently under review	Site-specific would be OK if it includes all media & review of inter-site effects or lack thereof	Site too large - will look at approach
9. Additivity	Actively seek information on synergism/antagonism	Additive unless database indicates otherwise	Default to additive; synergism/antagonism acceptable with proper data	Additivity is policy issue; revisit for critical chemicals

Soil and Other Contamination Source Interim Response Actions:

1. Basin F Liquids and Solids	Construct Tanks Oct 87 Liq. Trans. Dec 87 Construct Wastepile Apr 88	RCRA Closure Action Do not concur in technical approach, timing etc. presented in RFP	Concur conceptually except with technical concerns noted in review comments	Concur
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Table 6-1. Position Summary (Page 4 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
2. 1727 Sump (Task 30)	Assess Feb 88 Dec Docmt May 88 IA Initiation May 88 IA Complete Aug 88	Potential RCRA Closure action. Comments pending final review: check integrity; repair/replace alter- natives should be ex- amined	Agree; clarify objec- tives including exam- ination of sump integ- rity; repair/replace al- ternatives examined	Concur
3. HBSF (Task 34)	Assess Dec 87 Dec Docmt Mar 88 IA Initiated Mar 88 IA Complete Nov 89	RCRA Closure Action; Include manifest if offsite disposed	Concur	Concur
4. Fugitive Dust	Scheduled Completion no later than Mar 88; Possible fall appli- cation; Check waiver of IRA process	Concur; recommend palliative action in Fall 87	Concur with Army changes	Concur with Army changes
5. Sanitary Sewers	Assess 4th QTR FY88; Dec Docmt 1st QTR FY89; IA Initiated 2nd QTR FY89; IA Complete 2nd QTR FY90; Clarify objective; MOA/RMA coordination	Concur; clarify objec- tive; accelerate if possible	Concur; clarify objec- tive	Concur; clarify objec- tive. Accelerate if possible

Table 6-1. Position Summary (Page 5 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
6. Asbestos	Assess candidate locations (Task 24); clarify objective - removal from occupied bldgs, some outside lines, friable only	Agree; include potentially occupied bldgs and bldgs needed for remediation	Agree; include potentially occupied bldgs	Agree; include potentially occupied bldgs
7. Hot Spot Removal	Assess through Task 38 and new contract. Implementation complete Nov 89-Jul 90	Add to objective the design and construction of temporary storage facilities. Assessment of some sources not complete (motor pool, etc.); Need Phase 2 work; Review priority; otherwise concur	Add to objective the assumption of temporary storage facility; Assessment for some sources not complete; Need Phase 2; Review priority; otherwise concur	General concurrence; more dialog needed to prioritize individual sites

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Ground Water Interim Response Actions:

3. Ground Water System North of RMA	Assess Jan 88 Dec Docmt Apr 88 IA Initiated May 88 IA Complete Nov 89	Agree, but not appropriate to rule out two locations for collection systems	Agree, but not appropriate to rule out two locations	Concur
4. Boundary System Evaluations	1. North BS (Task 36, Annual Operations Assessment) 2. NW BS (Annual Operations Assmt)	1. Question NBS Phase 2 - May 89 too long for initiation 2. Concur assuming Task 25 & new wells are installed & treatment plant evaluated	1. Concur; understand Phase 2 to only be contingency 2. Concur	1. Concur 2. Concur

Position Summary

Topic	Army	CDH	EPA	Shell
5. Basin F Ground Water System	3. Irondale (Annual Operations Assmt)	3. Broaden Irondale for quarterly S&A during Western Tier RI/FS	3. OK, but need understanding that interim evaluation for each Western plume is being accelerated	3. Will do quarterly S&A; Concur
	4. Recharge Trench-check on separation from IRA process	4. Expedite trench & treatment plant modification implementation	4. Support trench be removed from IRA process	4. Support removing trench from IRA process
	Objective to be corrected Assess Jan 88 Dec Docmt Apr 88 IA Initiated May 88 IA Complete May 89	RCRA Closure Action; Clarify objective; keep drilling ongoing thru ESE or COE; evaluate use of NBS for implementation	Concur overall; clarify objective to be consistent with interim listing; Implement examination of size and scope of remedy - select option then	Concur except for objective revision
6. Well Closure	Check waiver on IRA process Assess Sep 87 Dec Docmt Dec 87 IA Initiated Sep 87	Generally concur except for refinements/clarification in comments to Task 37 Tech Plan; Revisit grandfathering; Check waiver for IRA process	Concur, but comments pending; Revisit grandfathering	Concur, except for refinements/clarification in comments to Task 37 Tech Plan; Revisit grandfathering

Table 6-1. Position Summary (Page 7 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
7. Basin A Neck GW System	Assess Oct 88 Dec Docmt Jan 89 IA Initiated Feb 89 IA Complete Aug 90	Generally concur; concern over timeframe-desire speedup	Concur; understand timeframes as maximums & will implement sooner if possible	Concur; suggest meeting on consensus on geology; need consensus on conceptual plan with Army
Sewers:				
1. Approach				
Existing Lines	Cut off communication channels; complete existing program; no additional RI work	Agree, subject to Phase I review	Incorporate ground water information; no further RI	No additional RI; pick up sewers as IRA
Removed Lines	Treat as soil source; modified bore spacing; extrapolate data from existing sewers if comparable	Worst Case	Assume worst case; no further RI	Extrapolate data if comparable (Section 35)
Buildings:				
1. Approach	3 Contamination classifications; no additional work; historical analysis	Assume contaminated, so no additional work; Need method for cleaning buildings after HCIC	Assume contaminated, so no additional work; Need method for cleaning buildings after HCIC	Assume contaminated, so no additional work; Need method for cleaning buildings after HCIC

Table 6-1. Position Summary (Page 8 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
Air:				
1. Approach	Regional program; EPA approach is being used agree	High wind events (Baseline and major source); otherwise in agreement worst-case events; CO	Basin F asbestos moni- toring; respirable dust <5 u may be concern; high wind and other otherwise agree and NOX, otherwise agree	Basin F asbestos moni- toring; high wind events (sources and North and South Plants); CO and NOX;
Chemistry:				
1. GC/MS vs. GC Phase I & Phase II	GC/MS for Phase I screen; GC for Phase II selectivity; reassess after action levels developed	Will consider Army position to document in plan for FS; concern on missing contamination in Phase I; will evaluate Army's offer to re-evaluate	Agree with Army approach	No concern
2. CRL vs. MDL	No change in procedures; use CRL	No concern if EPA is comfortable, consultant will review	Need support for assumption of very little risk difference, by comparing action levels & CRL & MDL risk levels and uncer- tainties	No concern

Table 6-1. Position Summary (Page 9 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
3. 10% GC/MS confirmation vs. dual column	Agree with Shell's approach	Best available technology	Want documented confirmation covered by QA/QC; agree with Shell's approach	If low concentration drives remediation, dual column should be used. Can be in FS or later phases
4. Non-target Cpd's and Target list	Will discuss and document way of resolving nontarget to target category - phthalates in particular	Non-target to target phthalate or other frequent-positive cpds particular concern	Add vinyl chloride as a target cpd for water for FS (has low RMCL)	No concern
5. Indicator levels	Using revised levels based on MOA input	No concern	No concern	No concern
6. Phase II DL for post Phase II work	Will examine when action levels are known	Agree	Agree	No concern
Saturated Zone Sampling:				
Approach	Limited Phase II in Basin A, South Plants, some trenches	Programmatically correct if include saturated samples as necessary; would like working group session on this issue	Agree for sources cited; should add Basin F; must consider FS	Look at ground water results and FS options first; Limited sampling OK

Table 6-1. Position Summary (Page 10 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
Hydro-Geo-Chemical Program:				
1. Vertical Extent of Contamination (physical/manmade)	Phased approach to increasing depth; review of historical abandoned wells determine integrity; sampling of historic wells	Ensure absence of contamination in Arapahoe with high degree of confidence	Concur	Concur
2. Identify potential for interaction of hydraulically conductive units	Detailed stratigraphic and structural analysis to define bedrock and alluvial pathways; continued investigation as required	Concur	Concur	Continue investigation as required, otherwise concur
3. Localized water balances (recharge/discharge)	Refine surface water balance for Havana Pond, Lower Lakes, offpost, Basin A, and North Boundary	Concur	Concur	Concur
4. Utilization of undocumented wells for chemical analysis	Appropriate for site-specific analysis if corroborating data exist. Restrict use to upper-most aquifer	Concur	Concur	Concur

Table 6-1. Position Summary (Page 11 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
5. Role of "guidance levels" in program	Used only as an indicator, not in designing programs; all data above detection level will be reported	Inappropriate to use guidance levels in RI prior to EA	Concur	Concur
6. Identification and analysis of geologic anomalies	Stepwise approach prioritized by FS needs	Concur	Concur	Concur
7. Need for source-specific monitoring	Monitoring will be conducted on a long term basis at each soil contamination source or source area contributing to ground water contamination. Upon completion of RI, monitoring will be continued as part of either the FS or new monitoring contract	Pending review	Concur	Concur
8. Nontarget analytes (Army degradation products)	Have performed analysis of degradation compounds; perform 10% GC/MS confirmation	Must have mechanism for inclusion of frequently occurring nontarget suite; also vinyl chloride	Address potential presence of vinyl chloride as an FS issue; otherwise concur pending review of Army work products	Ongoing program continuing; where compounds which may affect remediation are found, dual column GC is required
9. Spatial Extent of Contamination (new wells)	Stepwise approach; prioritize by RI and FS needs	Approach OK; data gaps remain pending review of CWP; concern over well priority system	Concur pending details with potential remedial	Concur with approach; will propose additional items impact
10. Integration of EPA Second Operable System Unit with RMA Program	Continue coordination and MOA review	Concur	Concur	Concur

Table 6-1. Position Summary (Page 12 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
11. Impact of SACWSD future actions (production wells) on RMA programs	All parties continue to share information	Concur	Concur	Concur
12. Identification of surrogate compounds list	No action pending RI; reevaluate during FS	Concur	Concur	Concur
13. Fractured shale as transport mechanism	Not currently under investigation	Pathways identified as part of RI; detailed investigation driven by FS	Evaluate and present data from ongoing program; driven by FS requirements	Investigate only if impacts remediation
14. 3-D Hydrologic Analysis of Paleo-channels, including Vertical Gradients in Irondale Gulch and NWBCS	Will investigate where cluster wells exist	Concur	Concur	Concur

Table 6-1. Position Summary (Page 13 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
"UNC" Areas:				
1. Approach	Document and photo review, ground water assessment, and site walkover provide principal approach; soil sampling provides supplemental information	Same as EPA	Would have done differently; but now need integration of ground water information and comparison with HCIC before any further field work	Agree with Army approach; have gone further than necessary
2. Boring Density	500', 750', or 1000' spacing, plus selected additional borings; Phase II's as necessary	See above; agree for now; Phase II needed in some areas	See above	Satisfactory
2. Boring Depth	5'; Phase II's as deep as necessary	Deeper; same approach as "sites"	See above	Satisfactory
3. Compositing	0-1' and 4-5' intervals	No compositing; missing "major" interval between 0-1' and 4-5'; use same approach as "sites"	See above (would not have composited)	Satisfactory
4. Analytical Suite	Semivolatiles; metals	Volatiles also needed	See above (would have analyzed for volatiles)	Satisfactory

Table 6-1. Position Summary (Page 14 of 14)

Position Summary

Topic	Army	CDH	EPA	Shell
Biota:				
Approach	ESE and MKE's combined programs will provide an adequate Biota Assessment	Concur, but add mule deer and eagle/raptor telemetry studies	Concur, but need to see results	Concur

one or more parties. This will most likely continue to be an evolving process where the program will be modified as new information dictates. The following pages present a slightly more detailed explanation of the topic than does Table 6-1, and it also presents the consensus position that has been selected by the Army and presented to the parties on October 1, 1987. This narrative follows the same order as shown in Table 6-1. Where all parties are in agreement, the narrative discussion is limited. Where positions differ significantly, the rationale for selection of the consensus position is explained.

RECORD OF DECISION

Topic 1: How many Records of Decision (RODs) should be prepared for the RMA problem?

Army Position: Two; one Onpost, one Offpost.

CDH Position: Multiple, preferably oriented by media.

EPA Position: Multiple; early offpost for ground water, media-oriented onpost as appropriate.

Shell Position: Minimize with 1-2 probable (depends upon integration of data).

Result: This topic has been overtaken by events. The RI/FS Process Document sets forth one Onpost and one Offpost ROD. More RODs are possible if the SAPC approves.

Topic 2: What should be the level of detail (see Section 2.4) in the selection of remedial strategies?

Army Position: Select remedial alternatives at the "technology" level, but keep open possibility of going one level lower if necessary.

CDH Position: Use equivalent levels throughout, but generally at "process" level.

EPA Position: Same as Army with possible addition of pilot studies.

Shell Position: Same as Army plus more pilot studies.

Result: Selection will occur at "technology" level; during the development of FS alternatives an assessment will be made of the need to conduct pilot scale studies at the process level.

Topic_3: What should be the staffing for the ROD?

Army_Position: Consistent with requirements of RI/FS process.

CDH_Position: None stated.

EPA_Position: EPA reviews ROD(s).

Shell_Position: None stated.

Result: This topic has been overtaken by events. The RI/FS Process Document sets forth the staffing requirements.

FEASIBILITY STUDY

Topic_1: What should the general FS approach be?

Army_Position: Functional equivalent to NCP.

CDH_Position: Follow NCP exactly, but ARARs necessary first.

EPA_Position: Functional equivalence with EPA NCP guidance; ARAR determination is iterative.

Shell_Position: Functional equivalence with NCP with "improvements".

Result: Approach will be not inconsistent with CERCLA, SARA, and NCP applicable guidance. The specific approach will be determined as the FS proceeds through discussions with the Organizations with the State. The initial ARAR determination will be completed soon, but this is an iterative process.

Topic_2: How does the Task 28 (Alternatives Assessment) approach compare with the NCP?

Army_Position: Task 28 is consistent with EPA guidance; requires multiple input from other tasks.

CDH_Position: Task 28 follows NCP guidance, but the implementation is not consistent. (This position is qualified pending complete review.)

EPA_Position: Task 28 follows the NCP. (This position is qualified pending complete review.)

Shell_Position: Agree with basic Task 28 approach, but it requires "fine tuning".

Result: The Task 28 approach is not inconsistent with CERCLA, SARA, and NCP applicable guidance. From a contractual viewpoint, the FS will probably have to be split. Technology Division/USATHAMA and Shell input will be factored in (see schedule for more details).

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Topic 3: Technology List

Army Position: Technologies for remediation will be selected from "universe" of 120 presented in the RI/FS planning meetings.

CDH Position: Must add technologies to address air media. (This position is qualified pending complete review.)

EPA Position: Army listing appears complete. (This position is qualified pending complete review.)

Shell Position: Have additions to list; need better definition of terms.

Result: FS will begin with all possible technologies on list of 120 plus additions recommended by other parties.

Topic 4: What screening criteria will be used for the technologies?

Army Position: Follow the three criteria cited by EPA guidance.

CDH Position: Need cleanup goals and response objectives before meaningful screening can occur; emphasize permanent reductions in mobility/toxicity/volume.

EPA Position: Army position is acceptable; consider new technologies; media-specific.

Shell Position: Screen new technologies as well; consider preliminary action levels, or at least ranges of action levels.

Result: The three proposed criteria will be utilized on regional, study area, and media bases to ensure maximum flexibility in the development of alternatives. The list resulting from this proposed screening process will then be examined to determine if additional criteria should be used to narrow it further.

Topic 5: Should ground water modeling be undertaken, by whom, and what general approach should be used?

Army Position: Ground water modeling is needed; the Army should be the lead; a top-down approach should be used beginning with a regional model(s), then are, then site-specific.

CDH Position: Concur with Army, but will consider option of GeoTrans lead.

EPA Position: Concur with Army, but will consider option of CDM lead.

Shell Position: Concur with Army; no preference for lead.

Result: The Army will lead the modeling effort using the top-down approach. All parties will participate in a modeling executive-level subcommittee to guide the models' development and implementation.

ENDANGERMENT ASSESSMENT

Topic_1: What approach should be followed?

Army Position: Will follow EPA/NCP guidance.

CDH Position: Concur with Army.

EPA Position: Concur with Army,

Shell Position: Generally concur with Army.

Result: The Army will follow EPA/NCP guidance.

Topic_2: Is the Task 35 (Endangerment Assessment) approach an acceptable implementation of the EPA/NCP guidance?

Army Position: Task 35 is consistent with EPA/NCP guidance.

CDH Position: The current written Technical Plan for Task 35 is not consistent with EPA/NCP guidance; need revised plan.

EPA Position: Task 35 appears to follow EPA guidance. (This position is qualified pending complete review.)

Shell Position: Task 35 appears to satisfy the NCP with some modifications needed such as CAG estimates and upper bounds; needs schedule on toxicity profiles and k_d .

Result: The Army will use the approach specified in the Task 35 Technical Plan.

Topic_3: Is the Integrated Endangerment Assessment approach acceptable?

Army Position: This approach addresses criteria from other tasks.

CDH Position: Disagree with Army's approach; onpost pathways must be revised; awaiting receipt of written plan.

EPA Position: Concur with Army, but need to resolve ground water pathway.

Shell Position: Concur with Army.

Result: The Army will use the proposed approach.

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Topic 4: Is the PPLV approach for soils acceptable?

Army Position: Plan to use PPLV approach; willing to consider changes in partition coefficients (k's) and assumptions.

CDH Position: The approach is conceptually acceptable, but needs modification or alternative method.

EPA Position: Concur with Army, but need all party review of the actual implementation, assumptions, and other details.

Shell Position: The proposed models could be appropriate, but k's and assumptions need work.

Result: The Army will use the PPLV approach, but is willing to consider recommended changes in input parameters, k's, and assumptions provided by other parties.

Topic 5: Should exposure controls be used and if so, when?

Army Position: Exposure controls should be used, and should be considered early in the RI/FS.

CDH Position: No controls should be used during remedial action evaluation, but can be considered in the ROD.

EPA Position: Pending.

Shell Position: Exposure controls should be used; no preference for when, except that they should be used to shorten the process if possible.

Result: Exposure controls will be considered in the development of the plan.

Topic 6: When should PPLVs be released?

Army Position: Within the Exposure Assessment.

CDH Position: As a package in the proper context; need to consider legal requirements (FOIA/CORA).

EPA Position: (Draft Position) As a package with supporting analysis and interpretation. (This position pending legal review.)

Shell Position: After the EA is substantially complete.

Result: The Army will release the PPLVs after the development and assembly of supporting analysis and interpretation.

Topic 7: Define the Integrated Endangerment Assessment goal of "Prevent Migration of Contamination".

Army Position: This is a long-term goal; on a short-term basis can permit changes in ground water contaminant concentrations.

CDH Position: Long-term goals shouldn't preclude specific remedial actions.

EPA Position: The goal is appropriate, but shouldn't preclude evaluation of remedial alternatives.

Shell Position: Short-term increases to ground water concentrations should be permitted; must word response objectives carefully.

Result: The Army will clarify the wording to indicate that this is a long-term goal. Short-term increases will be considered in the evaluation of remedial alternatives.

Topic 8: Should a stepwise approach be used in the Exposure/Toxicity Assessment?

Army Position: Willing to do this on a Study Area basis.

CDH Position: Pending.

EPA Position: Site-specific approach would be acceptable if it includes all media and a review of inter-site effects or lack thereof.

Shell Position: Site appears to be too large for this approach, but will look at the approach.

Result: The Army is willing to work out a scheduled review process consistent with the Technical Program Plan (see schedule for more details).

Topic 9: What approach should be used to address additivity of effects of compounds?

Army Position: Actively seek information on synergism and antagonism.

CDH Position: Assume additivity unless data indicate otherwise.

EPA Position: Default to additivity; synergism/antagonism acceptable with proper data.

Shell Position: Additivity is a policy issue; need to revisit for critical chemicals.

Result: The Army will assume additivity unless data indicate otherwise, and will simultaneously actively seek information on synergism/antagonism.

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SOIL AND OTHER CONTAMINATION SOURCE INTERIM RESPONSE ACTIONSTopic 1: Basin F Liquids and Soils Removal

Army Position: Implement IRA with tank construction completed in December 1987, liquid transfer in summer 1988, and construction of waste pile by April 1988.

CDH Position: This represents a RCRA Closure Action; do not concur in technical approach, timing, etc. presented in RFP.

EPA Position: Concur with Army conceptually with technical concerns noted in review comments.

Shell Position: Concur with Army.

Result: The Army will continue its current approach. Each parties' review comments will be examined in the context of ARARs. If changes are found to be necessary, the contract will be modified.

Topic 2: 1727 Sump

Army Position: Complete assessment by February 1988, prepare decision document by May 1988, initiate IRA by May 1988, and complete IRA by August 1988.

CDH Position: This represents a potential RCRA Closure action; need to check integrity of sump; repair/replacement alternatives should be examined. (This position is qualified pending complete review.)

EPA Position: Concur with Army; need to clarify objectives including examination of sump integrity and examination of repair/replacement alternatives.

Shell Position: Concur with Army.

Result: Army will incorporate an examination of the sump integrity and repair/replacement alternatives as part of an IRA.

Topic 3: Hydrazine Blending and Storage Facility

Army Position: Complete assessment by December 1987, prepare decision document by March 1988, initiate IRA by March 1988, complete IRA by November 1989.

CDH Position: This represents a RCRA Closure action; must include a manifest if materials are disposed off-site.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: The Army will continue its current approach.

Topic_4: Fugitive Dust Control in the Basin A Area

Army_Position: Scheduled for completion no later than March 1988, with possible application in fall 1987; must check for waiver of Army IRA process.

CDH_Position: Concur with Army; recommend palliative action in fall 1987.

EPA_Position: Concur with Army changes.

Shell_Position: Concur with Army changes.

Result: Army agrees to attempt application in fall 1987, and will request waiver of Army IRA process that could potentially delay implementation.

Topic_5: Sanitary Sewers

Army_Position: Complete assessment in 4th quarter FY88, prepare decision document 1st quarter FY89, complete IRA in 2nd quarter FY90.

CDH_Position: Concur with Army, but clarify objectives and accelerate if possible.

EPA_Position: Concur with Army, but clarify objective.

Shell_Position: Concur with Army, but clarify objectives and accelerate if possible.

Result: Army will continue current approach, but will clarify objectives and coordinate with all parties involved.

Topic_6: Asbestos Removal

Army_Position: Assess candidate locations for asbestos removal under Task 24; clarify objective to include removal from occupied buildings, some outside lines; friable asbestos only.

CDH_Position: Concur with Army, but include potentially occupied buildings and buildings needed for remediation.

EPA_Position: Concur with Army, but include potentially occupied buildings.

Shell_Position: Concur with Army, but include potentially occupied buildings.

Result: Army will modify current approach to include potentially occupied buildings.

Topic 7: Hot Spot Removal

Army Position: IRA will be assessed through Task 38 and new contract; implementation complete between November 1989 and July 1990.

CDH Position: Add to objective the design and construction of temporary storage facilities; assessment of some sources not yet complete (motor pool, etc.); need Phase II work; review priority; otherwise concur with Army.

EPA Position: Add to objective the assumption of temporary storage facilities; assessment for some sources not complete; review priority; otherwise concur with Army.

Shell Position: Generally concur with Army, but more dialog needed to prioritize individual sites.

Result: Future scope as a task to new contract. Within scoping incorporate parties' views towards prioritization of site, action levels, and disposition of materials.

GROUND WATER INTERIM RESPONSE ACTIONS

Topic 3: Ground Water System North of RMA

Army Position: Complete assessment by January 1988, prepare decision document by April 1988, initiate IRA by May 1988, complete IRA by November 1989.

CDH Position: Concur with Army, but it is not appropriate to rule out two locations for collection systems.

EPA Position: Concur with Army, but it is not appropriate to rule out two locations for collection systems.

Shell Position: Concur with Army.

Result: Both the northerly and northwesterly plumes will be incorporated into the assessment; otherwise Army will continue its current approach.

Topic 4a: Boundary System Evaluations, North Boundary System

Army Position: Perform annual operations assessment.

CDH Position: Question North Boundary System Phase II - May 1989 too long for initiation.

EPA Position: Concur with Army; understand Phase II to only be contingency.

Shell Position: Concur with Army.

Result: Army will continue current approach. Phase II to be considered contingency only.

Topic 4b: Boundary System Evaluations, Northwest Boundary System

Army Position: Perform annual operations assessment.

CDH Position: Concur with Army assuming Task 25 and new wells are installed and treatment plant evaluated.

EPA Position: Concur with Army.

Shell Position: Concur with Army.

Result: Army will continue current approach.

Topic 4c: Boundary System Evaluations, Irondale

Army Position: Shell continues to perform annual operations assessment.

CDH Position: Broaden Irondale for quarterly sampling and analysis during Western Tier RI/FS.

EPA Position: Concur with Army, but need understanding that interim evaluation for each western plume is being accelerated.

Shell Position: Concur with Army; will conduct quarterly sampling and analysis.

Result: Shell will expand to quarterly sampling and analysis. Otherwise continue current approach.

Topic 4d: Boundary System Evaluations, Recharge Trenches

Army Position: Check on separation from IRA process.

CDH Position: Expedite trench and treatment plant modification implementation.

EPA Position: Support idea that trench be removed from IRA process.

Shell Position: Support idea that trench be removed from IRA process.

Result: Army sought waiver of IRA process for trenches, however, the Colorado Attorney General's Office did not concur. The Army will follow the process.

Topic 5: Basin F Ground Water System

Army Position: Clarify objective, complete assessment by January 1988, prepare decision document by April 1988, initiate IRA by May 1988, complete IRA by May 1989.

CDH Position: This represents a RCRA Closure action; need to clarify objective; keep drilling ongoing through current contractor or Corps of Engineers; evaluate use of North Boundary System for implementation.

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EPA_Position: Concur with Army overall; clarify objective to be consistent with interim listing; implement examination of size and scope of remedy, then select option.

Shell_Position: Concur with Army except objective must be revised.

Result: Army will clarify objective and continue current approach. Army will also involve parties in the determination of the size and scope of the remedy.

Topic_6: Well Closure

Army_Position: Check waiver on IRA process, complete assessment by September 1987, prepare decision document by December 1987, initiate IRA by September 1987.

CDH_Position: Generally concur with Army except for refinements and clarification in comments to Task 37 Technical Plan; revisit grandfathering; check waiver for IRA process.

EPA_Position: Concur with Army, but further comments pending; revisit grandfathering.

Shell_Position: Concur with Army, except for refinements and clarification in comments to Task 37 Technical Plan; revisit grandfathering.

Result: Army requested waiver of IRA process, however, the Colorado Attorney General's office did not concur. The Army will continue current approach.

Topic_7: Basin A Neck Ground Water System

Army_Position: Complete assessment by October 1988, prepare decision document by January 1989, initiate IRA by February 1989, complete IRA by August 1990.

CDH_Position: Generally concur with Army, but have concern over time frame; desire speed-up.

EPA_Position: Concur with Army; understand time frames as maximums and will implement sooner if possible.

Shell_Position: Concur with Army; suggest meeting on consensus on geology; need consensus on conceptual plan with Army.

Result: Army will continue current approach, but accelerate effort to the maximum extent practicable. Army will meet with other parties to pull together geology and hydrology data.

REMEDIAL INVESTIGATION. SEWERS

Topic 1: What approach should be utilized for existing lines?

Army Position: For existing lines, cut off communication channels, complete existing program, no additional RI work.

CDH Position: Position pending review of Phase I data and reports.

EPA Position: Incorporate ground water information; no further RI work.

Shell Position: No additional RI work; pick up sewers as IRA.

Result: Army will complete existing program, incorporating ground water information into IRA assessments and Study Area Reports.

Topic 2: What approach should be used for lines that have been removed?

Army Position: Treat removed lines as a soil source; use modified bore spacing; extrapolate data from existing sewers is comparable.

CDH Position: Assume worst case conditions.

EPA Position: Assume worst case conditions, no further RI.

Shell Position: Extrapolate data if comparable, for example in Section 35.

Result: Army will treat removed lines as soil sources in the Study Area Reports, and will extrapolate data from existing sewers if comparable. If data are not comparable, assume worst case conditions.

REMEDIAL INVESTIGATION. BUILDINGS

Topic: What approach should be used to address building contamination?

Army Position: Assume three contamination classifications based primarily upon historical analysis; no additional RI work.

CDH Position: Assume all are contaminated, so no additional work required; need method for cleaning buildings after HCIC numbers are available.

EPA Position: Assume all are contaminated, so no additional work required; need method for cleaning buildings after HCIC numbers are available.

Shell Position: Assume all are contaminated, so no additional work required; need method for cleaning buildings after HCIC numbers are available.

Result: No additional RI work will be performed for the buildings/structures which are assumed to be contaminated. The Army will investigate sampling and analytical procedures to verify condition of buildings/structures assumed clean.

REMEDIAL INVESTIGATION, AIR

Topic: What approach should be used to address air contamination?

Army Position: Conduct regional program; EPA approach is being used.

CDH Position: Need to monitor high wind events (baseline and major source areas); otherwise concur with Army.

EPA Position: Need Basin F asbestos monitoring; respirable dust less than 5 microns may be a concern; need high wind and other worst-case event monitoring; need CO and NOX; otherwise concur with Army.

Shell Position: Need Basin F asbestos monitoring, high wind events (at sources and North and South Plants), and CO and NOX; otherwise concur with Army.

Result: Army will continue current EPA approach. Comprehensive Monitoring Contract will be used to expand air study to include high wind events, CO, and NOX. Basin F monitoring is part of the IRA for that area. All new and timely information will be incorporated into the FS.

REMEDIAL INVESTIGATION, CHEMISTRY

Topic 1: What analytical methods for organics are appropriate under RI efforts?

Army Position: Use GC/MS for Phase I as a screening tool; use GC in Phase II for selectivity and sensitivity; re-assess after action levels have been established.

CDH Position: Will consider Army position to document in plan for Feasibility Study; concern over missing contamination in Phase I; will evaluate Army's offer to re-evaluate.

EPA Position: Concur with Army approach.

Shell Position: No concern over Army's position.

Result: Army will continue current approach.

Topic 2: Should the Method Detection Limit (MDL) or Certified Reporting Limit (CRL) be used to report RI data?

Army Position: No change in current procedures; continue to use CRL.

CDH Position: Does not concur with use of CRL.

EPA Position: Need support for assumption of very little risk difference by comparing action levels with CRL and MDL risk levels and uncertainties.

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Shell Position: No concern over Army's position.

Result: Army will continue to utilize USATHAMA-acceptable CRL. Will continue to work with EPA to standardize approach.

Topic 3: What approach should be used to confirm GC data?

Army Position: Use 10 percent GC/MS confirmation rather than dual column.

CDH Position: Use best available technology.

EPA Position: Want documented confirmation covered by QA/QC; concur with Shell position.

Shell Position: If low concentration drives remediation, should use dual columns, but this can occur in the Feasibility Study or later stages of cleanup.

Result: Army will continue current approach of 10 percent GC/MS confirmation except if low concentrations drive remediation. In these cases, a dual column confirmation will be used, if methods are available.

Topic 4: Can nontarget compounds be added to the target list?

Army Position: Will discuss and document way of resolving nontarget to target category, for phthalates in particular.

CDH Position: Nontarget to target phthalate or other frequent-positive compounds are of particular concern.

EPA Position: Add vinyl chloride as a target compound for water under the Feasibility Study due to its low RMCL.

Shell Position: No concern over Army's position.

Result: Army will document its current approach, paying particular attention to phthalates and vinyl chloride. This document will be provided to other parties for review.

Topic 5: Is the current use of indicator levels acceptable?

Army Position: Army is using revised indicator levels based upon input from parties.

CDH Position: No concern over Army's position.

EPA Position: No concern over Army's position.

Shell Position: No concern over Army's position.

Result: Army will continue current approach.

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Topic 6: Should Phase II detection levels be used for post-Phase II work?

Army Position: Will examine when action levels are known.

CDH Position: Concur with Army.

EPA Position: Concur with Army.

Shell Position: No concern over Army's position.

Result: Army will re-examine issue when action levels are known.

REMEDIAL INVESTIGATION, SATURATED ZONE SAMPLING

Topic: What approach should be used to investigate soils in the saturated zone?

Army Position: Conduct saturated zone sampling only in limited Phase II studies in Basin A, South Plants, and some trenches.

CDH Position: Army is programmatically correct if it includes saturated zone samples as necessary; would like working group session on this issue.

EPA Position: Concur with Army for sources cited; should add Basin F; must consider Feasibility Study needs.

Shell Position: Look at ground water results and Feasibility Study options first; limited saturated zone sampling is acceptable.

Result: Army will use limited Phase II saturated zone sampling in Basin A, South Plants, Basin F, and some trenches. Army will also examine the need for more data in the Feasibility Study. Separate meeting with parties to further discuss.

REMEDIAL INVESTIGATION, HYDRO-GEO-CHEMICAL PROGRAM

Topic 1: How should the vertical extent of contamination (physical/man-made) be examined?

Army Position: Use phased approach to increasing depth; review of historical abandoned wells to determine their integrity; sampling of selected historic wells.

CDH Position: Ensure absence of contamination in the Arapahoe Formation with a high degree of confidence.

EPA Position: Concur with Army Position.

Shell Position: Concur with Army position.

Result: Continue with current approach.

Topic_2: What approach should be used to identify the potential for interaction of hydraulically conductive units?

Army_Position: Perform detailed stratigraphic and structural analysis to define bedrock and alluvial pathways; continue investigation as required.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_3: What approach should be used to define localized water balances (recharge/discharge)?

Army_Position: Refine surface water balance for Havanna Pond, Lower Lakes, offpost, basin A, and North Boundary.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_4: Should undocumented wells be utilized for chemical analysis?

Army_Position: Use is appropriate for site-specific analysis if corroborating data exist; restrict use to uppermost aquifer.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_5: What should be the role of "guidance levels" in the program?

Army_Position: Use only as an indicator, not in designing programs; all data above detection level will be reported.

CDH_Position: Inappropriate to use guidance levels in RI prior to EA.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

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Topic 6: What approach should be used to identify and analyze geologic anomalies?

Army Position: Use stepwise approach prioritized by Feasibility Study needs.

CDH Position: Concur with Army.

EPA Position: Concur with Army.

Shell Position: Concur with Army.

Result: Continue with current approach.

Topic 7: What approach should be used to identify the need for source-specific monitoring?

Army Position: Monitoring will be conducted on a long term basis at each soil contamination source or source area contributing to ground water contamination. Upon completion of RI, monitoring will be conducted as part of either the Feasibility Study or new monitoring contract.

CDH Position: Pending.

EPA Position: Concur with Army.

Shell Position: Concur with Army.

Result: Continue with current approach.

Topic 8: What approach should be used to handle nontarget analytes (including Army agent degradation products)?

Army Position: Have already performed analysis of degradation products; perform 10 percent GC/MS confirmation.

CDH Position: Must have mechanism for inclusion of frequently-occurring nontarget suite, including vinyl chloride.

EPA Position: Address potential presence of vinyl chloride as a Feasibility Study issue; otherwise concur with Army position, pending review of Army work products.

Shell Position: Ongoing program continuing; where compounds which may affect remediation are found, dual column GC is required.

Result: Army will document current approach and provide to other parties for review.

Topic_9: What approach should be used to identify the spatial extent of contamination (new wells)?

Army_Position: Utilize stepwise approach; prioritize by Remedial Investigation and Feasibility Study needs.

CDH_Position: Concur with Army, but data gaps remain pending review of CWP; concern over well priority system.

EPA_Position: Concur with Army pending details.

Shell_Position: Concur with Army approach; will propose additional items with potential remedial impact.

Result: Continue with current approach.

Topic_10: What approach should be used to integrate the EPA Second Operable Unit with the RMA Program?

Army_Position: Continue coordination and all-party review.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_11: What approach should be used to identify the impact of SACWSD future actions (production wells) on RMA programs?

Army_Position: All parties to continue to share information.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_12: What approach should be used to identify surrogate compounds list?

Army_Position: No action pending Remedial Investigation; re-evaluate during the Feasibility Study.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

Topic_13: What approach should be used to investigate fractured shale as a transport mechanism?

Army_Position: Not currently under investigation.

CDH_Position: All pathways should be identified as part of the Remedial Investigation; detailed investigation should be driven by the Feasibility Study.

EPA_Position: Evaluate and present data from ongoing program; driven by Feasibility Study requirements.

Shell_Position: Investigate only if it impacts remediation.

Result: Army will review existing data in Study Area Reports. Investigate further only if it impacts remediation.

Topic_14: What approach should be used to investigate the three-dimensional hydrology of paleochannels, including vertical gradients in Irondale Gulch and at the Northwest Boundary Control System?

Army_Position: Will investigate where cluster wells exist.

CDH_Position: Concur with Army.

EPA_Position: Concur with Army.

Shell_Position: Concur with Army.

Result: Continue with current approach.

REMEDIAL INVESTIGATION. "UNC" AREAS

Topic_1: What approach should be followed to investigate the "UNC" areas?

Army_Position: Document and photograph review, ground water assessment, and site walkover provide principal approach; soil sampling provides supplemental information.

CDH_Position: Concur with EPA position.

EPA_Position: Would have done differently, but now need integration of ground water information and comparison with HCIC numbers before any further field work.

Shell_Position: Concur with Army approach; have gone further than is necessary.

Result: Continue with current approach. Determine need for any additional work after HCIC numbers become available. Separate meeting with parties to discuss further.

Topic_2: What boring density should be used in the "UNC" areas?

Army_Position: 500', 750', or 1,000' spacing, plus selected additional borings; Phase II's as necessary.

CDH_Position: See Topic 1; concur with Army position for now; Phase II needed in some areas.

EPA_Position: See Topic 1.

Shell_Position: Army position is satisfactory.

Result: Continue with current approach.

Topic_3: To what depth should "UNC" area borings penetrate?

Army_Position: 5'; Phase II's as deep as necessary.

CDH_Position: Deeper; same approach as "sites".

EPA_Position: See Topic 1.

Shell_Position: Army position is satisfactory.

Result: Continue with current approach.

Topic_4: What compositing scheme should be used for "UNC" borings?

Army_Position: Composite 0-1' and 4-5' intervals.

CDH_Position: Do not composite; missing "major" interval between 0-1' and 4-5'; use same approach as "sites".

EPA_Position: See Topic 1; would not have composited.

Shell_Position: Army position is satisfactory.

Result: Continue with current approach.

Topic_5: What analytical suite should be used for "UNC" area samples?

Army_Position: Use semi-volatiles, metals.

CDH_Position: volatiles also needed.

EPA_Position: See Topic 1; would have analyzed for volatiles.

Shell_Position: Army position is satisfactory.

Result: Continue with current approach.

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REMEDIAL INVESTIGATION, BIOTA

Topic: What approach should be followed to investigate biota contamination?

Army Position: Army and Shell combined programs will provide an adequate biota assessment.

CDH Position: Concur with Army, but need to add mule deer and eagle/raptor telemetry study.

EPA Position: Concur with Army, but need to see results.

Shell Position: Army position is satisfactory.

Result: Continue with current approach; CDH to add mule deer study; USFWS to add eagle/raptor telemetry.

It is clear from this summary that there is general concurrence among all parties on programmatic aspects of the current RI/FS and IRA efforts. In those cases where there is disagreement, there are either programs underway to resolve the differences or the differences do not have a major impact on the overall contamination assessment being performed at RMA.

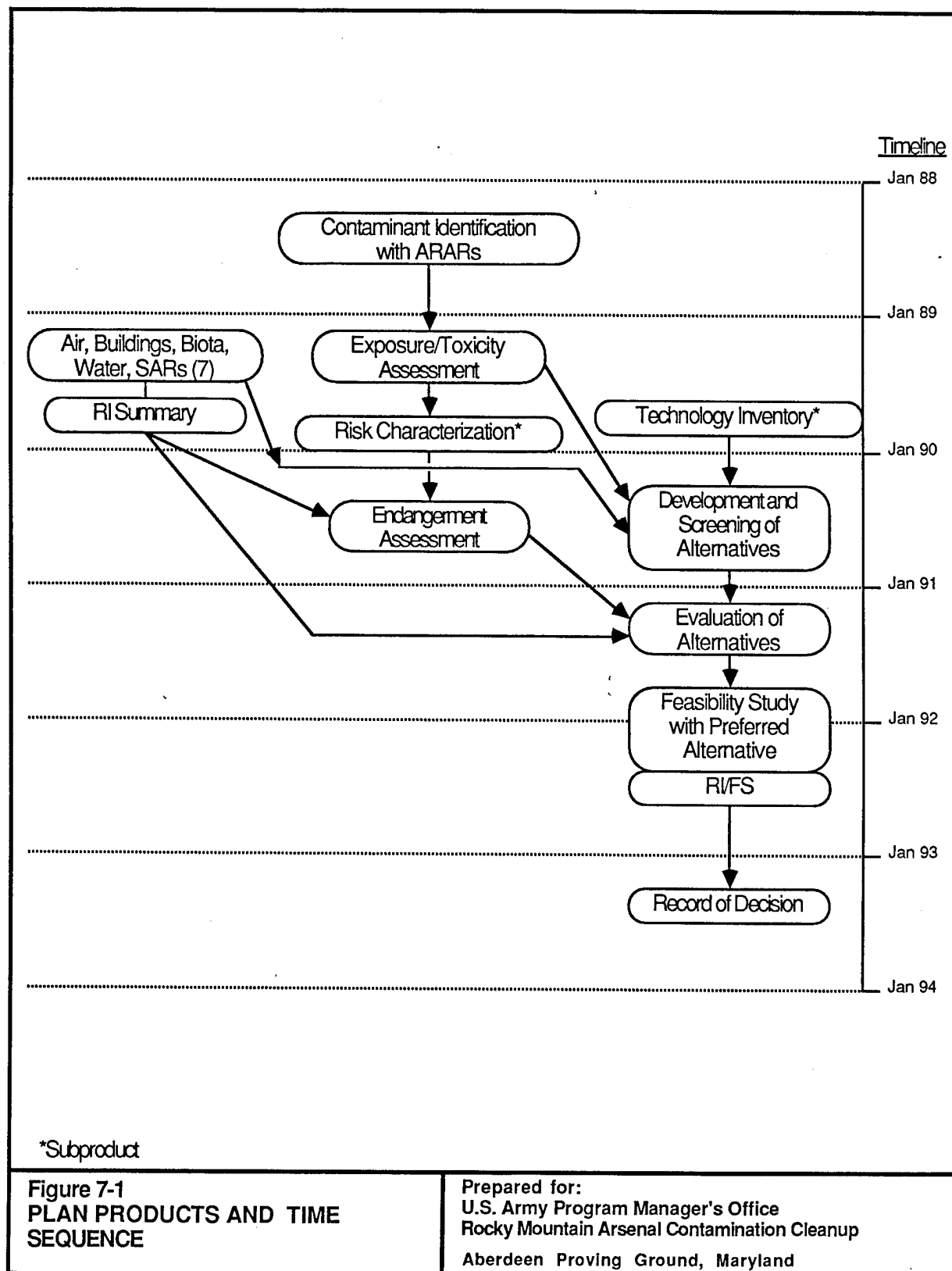
7.0 SCHEDULE

The primary objective of the schedule is to designate deadlines for the RI/FS Plan for RMA which are subject to penalties under the Consent Decree. A secondary objective is to provide program management and resource information to the Organizations and the State.

This schedule has been developed using the November 24, 1987 DOJ version of the RI/FS Process Document and the October 26, 1987 DOJ version of the Consent Decree for U.S. vs. Shell Oil Company. The software used is Microsoft Project, Version 3.0. The file is RMAOK1.ACT for the RI/FS schedule and IRA.ACT for the Interim Response Action schedule. A data disk with these files is located in a protective sleeve at the end of this document. A glossary and Gantt charts of both schedules are included in Appendix B.

Conceptually, this process is much more linear than the process outlined in the Army's March 4, 1987 schedule. Events have been scheduled as modules, reflecting two major changes to the program: process and penalties. The RI/FS process influences the schedule because comment and response activities have been formalized. The result is that elements which are dependant on prior work can not be finalized until the prior work is finalized. Penalties affect the amount of time assumed for the each step in the program. All parties are assumed to take the maximum amount of time possible under the process because these steps are not cause for recalculating the schedule (whereas disputes are). This changed approach leads to an end date that is very much later than originally anticipated. Figure 7-1 illustrates major products in the plan in time sequence with precedences.

The critical path for this process is: Soils Investigations - SARs - RI - Endangerment Assessment - Evaluation of Alternatives - FS with Preferred Alternative. The five Products on the critical path are about 255 days long each and total approximately 3.8 years, giving a finish date of February 1, 1992 for the Onpost FS.



The offpost critical path is: Offpost CAR - RI/EA - FS with Preferred Alternative. A finish date of March 29, 1989 is predicted. Figure 7-2 illustrates major products in the plan.

The IRAs are treated completely separately from the RI/FS and are included here only from the point of schedule. A complete discussion of the IRAs can be found in Section 3.0.

7.1 SCHEDULE STRUCTURE AND ASSUMPTIONS

As noted above, the schedule is basically a linear analysis containing the blocks or modules described in the RI/FS Process and Consent Decree. There are six different types of modules in the schedule: Technical Plans, Products, Subproducts, Other Deliverables, Dispute Resolution, and the RI/FS/ROD. Each of these has been computed without disputes, although these activities appear as dummies in order to facilitate updates.

The schedule also reflects the addition of the SARs, and the addition of an ARAR Document in the EA. Task 23, Soils/Ground Water Integration, has a more streamlined approach, and contains only a final RI Report. The RI/FS/ROD decision process has been formalized as described in Section 1.5.

7.1.1 Technical Plans

Technical plans follow an eight step process and are subject to dispute resolution. The approach followed throughout the schedule assumes that wherever the possibility exists for more time to be used for comment or review, it is taken (e.g., if a 30-day comment periods has a 15-day extension, the schedule uses 45 days). The process applies only to Technical Plans which describe new Products or Subproducts. Task Plans, which are created only for the purpose of resource management, are not subject to dispute (e.g., Phase II Tasks). There are currently no new Technical Plans.

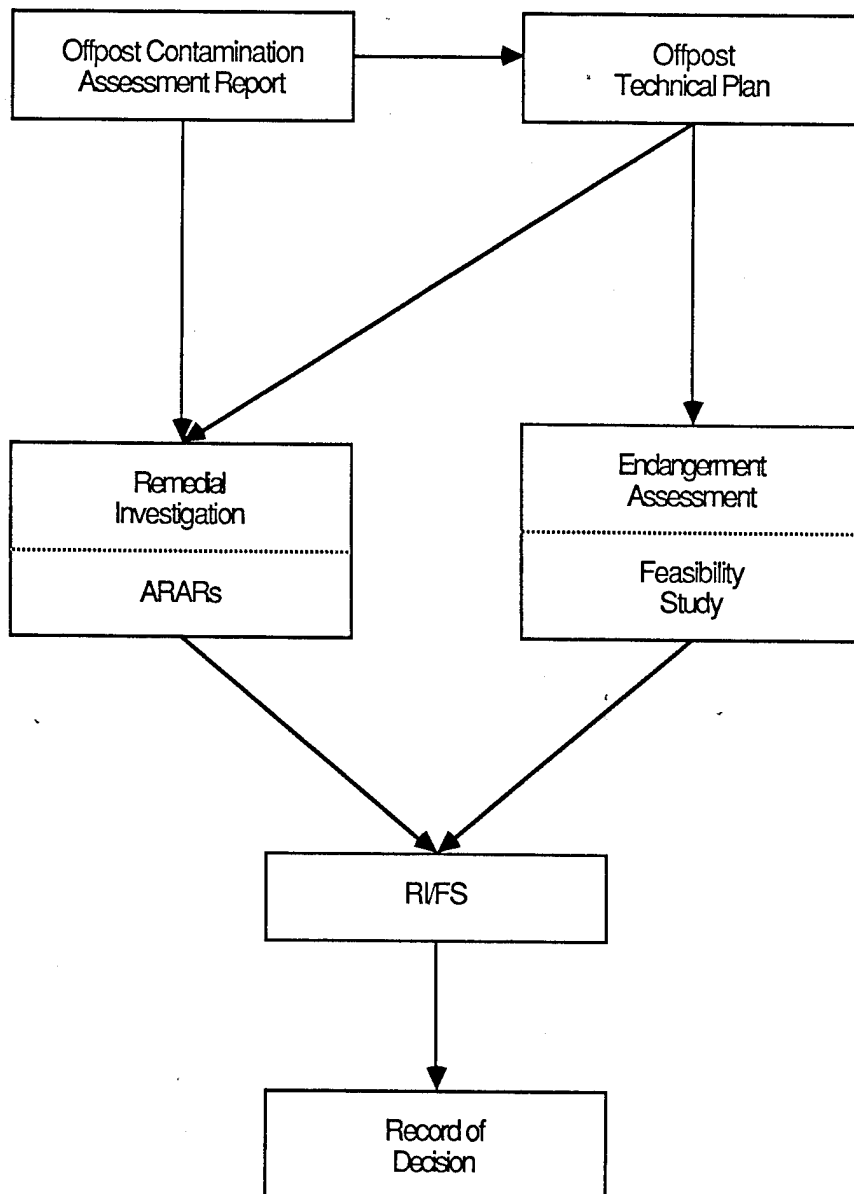


Figure 7-2
OFFPOST ROD FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

The step-by-step process is as follows:

Activity	Duration
1. Prepare Technical Plan	Varies
2. Internal Review (Blue Technical Plan)	45 days
3. Parties and State (PAS) Comments (Brown Technical Plan)	30 days
4. Prepare White Technical Plan	45 days
5. Dispute or Finalize	15 days
6. Dispute (see Section 7.1.4)	(14/49/79 days)
7. Rewrite and Reissue	(35 days)
8. Finalize Plan (White Technical Plan)	7 days
<u>Total (without dispute)</u>	<u>142 days</u>

Note that those activities associated with dispute resolution (numbers 6 and 7) are not invoked because the schedule would have to be recalculated in those cases. Also note that there is a "second review" afforded by the dispute resolution process.

7.1.2 Products

Products follow an eight step process and are subject to dispute resolution. The time allowed for preparation of the product varies with the difficulty and complexity of the document and is usually 60, 90, or 120 days unless otherwise mandated by the Process or Decree. All of the Products have an ARAR determination of differing degree embedded in the process. The internal review step of 45 days includes the legal review necessary to match a technical report with a legal determination.

The step-by-step process is as follows:

Activity	Duration
1. Prepare Document	60/90/120 days
2. Internal Review (Blue Product)	45 days
3. PAS Comments (Brown Product)	45 days
4. Prepare White Product	50 days
5. Dispute or Finalize	15 days
6. Dispute Meetings	(14/49/79 days)

7. Rewrite or Reissue	(35 days)
8. Finalize (White Product)	7 days
Total (without disputes)	252 days

As before, activities 6 and 7 are not invoked unless there is dispute resolution. The deadlines reported in the plan are those associated with the issuance of the draft Product (the end of activity 2).

7.1.3 Subproducts and Other Deliverables

Subproducts are structured in the same way as Products except that there is no Dispute Resolution process. The process is exactly the same as the first four activities in Products above. The step-by-step process is as follows:

Activity	Duration
1. Prepare Document	30/60/90 days
2. Internal Review (Blue Subproduct)	45 days
3. PAS Comments (Brown Subproduct)	45 days
4. Prepare White Subproduct	50 days
Total	200 days

As can be seen, reclassifying Products as Subproducts saves only 52 days, or 17 percent of the time needed to produce a document under the process. However, preparation of the following Subproducts or Products is assumed to follow activity 3; a real savings of 92 days. Other Deliverables are provided for PAS review only. Preparation of the following Subproducts and Products is assumed to proceed immediately after the issuance of the Other Deliverables (activity 2).

7.1.4 Dispute Resolution

Dispute Resolution is a very tightly managed process outlined in the Consent Decree rather than in the RI/FS Process Document because only Signatories to the decree can raise issues to Dispute Resolution. Three outcomes are possible depending on the level at which the dispute is resolved. The step-by-step process is as follows:

Activity	Duration
1. RI/FS Council	14 days
2. SAP Committee	30 days
3. Send to FRC?	5 days
4. Final Review Committee	30 days
5. Rewrite and Reissue Document	35 days

In the schedule, activities 1-4 are combined and called "Dispute Meetings". Disputes can be resolved at the end of activities 1, 3, and 4. The dummy tasks in the schedule show all disputes being resolved by the SAP Committee (49 days). An exception is the final opportunity for Dispute Resolution, the "FS Product", which has the dispute resolved by the FRC (79 days).

7.1.5 RI/FS/ROD Process

The assumptions for this process are completely described by the RI/FS Process Document and are not repeated here. The step-by-step process is as follows:

Activity	Duration
1. Prepare RI/FS Report	30 days
2. RI/FS Federal Register	14 days
3. Public Comment	60 days
4. Revise RI/FS into Draft ROD	75 days
5. PAS Comment Draft ROD	30 days
6. Rewrite/Reissue ROD	30 days
7. PAS Concurrence	15 days
8. Dispute Meetings (FRC)	(79 days)
9. Rewrite/Reissue Final ROD	(45 days)
10. Finalize Final ROD	7 days
11. State Concurs or Sues	30 days
12. ROD Notice of Availability	7 days
13. Begin Remedial Action	7 days
<u>Total (without dispute)</u>	<u>298 days</u>
<u>Total (with dispute)</u>	<u>422 days</u>

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Activities number 8 and 9 are dispute resolution steps and are included in the schedule as dummy tasks.

7.2 REMEDIAL INVESTIGATION

The RI contains 12 Products, shown below. All Phase I CARs are considered Subproducts. Structurally, the RI has not changed significantly from the Army's March 4, 1987 schedule (see Figure 7-3). Task 23, Soils/Ground Water Integration, has been replaced by seven SARs which take an equivalent amount of time to produce. The SARs and the RI Summary Report are on the critical path.

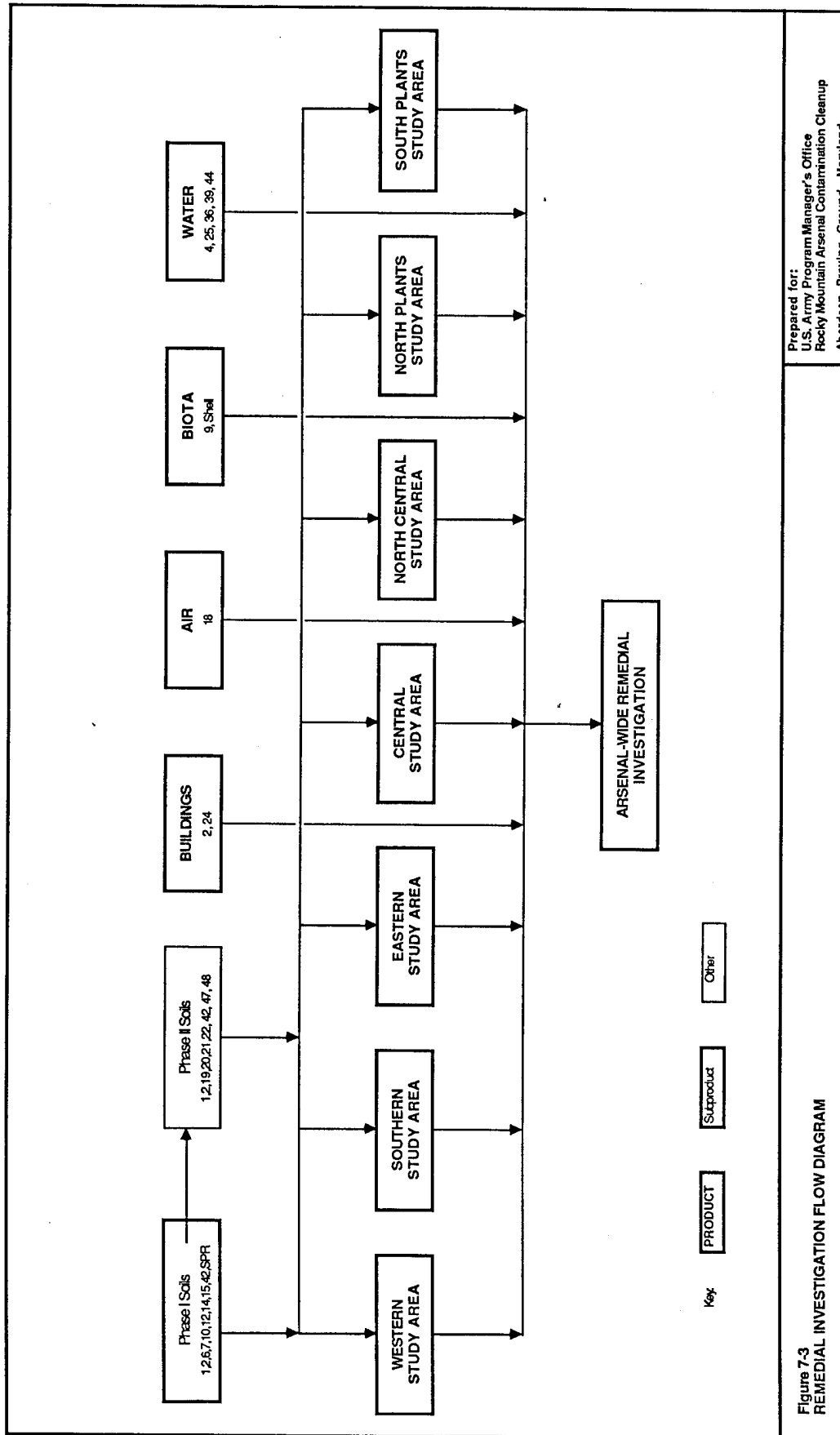
Unfortunately, the current Task Order contract will not be able to complete the RI program (or the EA or FS) using this schedule. The schedule contains several additional tasks assumed to begin on October 1, 1988 or later, and are designated "RIFS#". These tasks (as well as the overall schedule) attempt to reflect the contractual procurement realities of the program. Section 4.2 indicates current tasks being considered under the new contract. If the new contract is delayed, substantial slips could occur throughout the RMA program.

Critical dates for the 12 RI Products are as follows:

PRODUCTS	DATE
Air RI	15 Mar 89
Buildings RI	15 Mar 89
Water RI	15 Mar 89
Biota RI	15 Mar 89
Western SAR	15 Mar 89
South Plants SAR	15 Mar 89
Central SAR	15 Mar 89
North Central SAR	15 Mar 89
North Plants SAR	15 Mar 89
Eastern SAR	15 Mar 89
Southern SAR	15 Mar 89
Final RI	8 Oct 89

7.3 ENDANGERMENT ASSESSMENT

The EA has three Products and one Subproduct. The final EA is on the critical path.



The EA process has had a significant addition since the March 4, 1987 schedule; a comprehensive chemical-specific ARAR determination is included with the Contaminant Identification. The process is essentially linear. Figure 7-4 outlines the process.

Critical Dates for the EA are as follows:

PRODUCTS	DATE
Contaminant Identification/ARAR Determination	6 Jun 88
Exposure Assessment	15 Mar 89
Endangerment Assessment	17 Jul 90

7.4 FEASIBILITY STUDY

The Feasibility Study contains three Products and four Subproducts. The process is linear and is displayed in Figure 7-5. The FS approach will incorporate the SARs produced in the RI as separate chapters beginning with the Development and Screening of Alternatives Report (DSA). Advanced Technologies, Incineration, Disposal Facility, and the Technology Inventory are Subproducts.

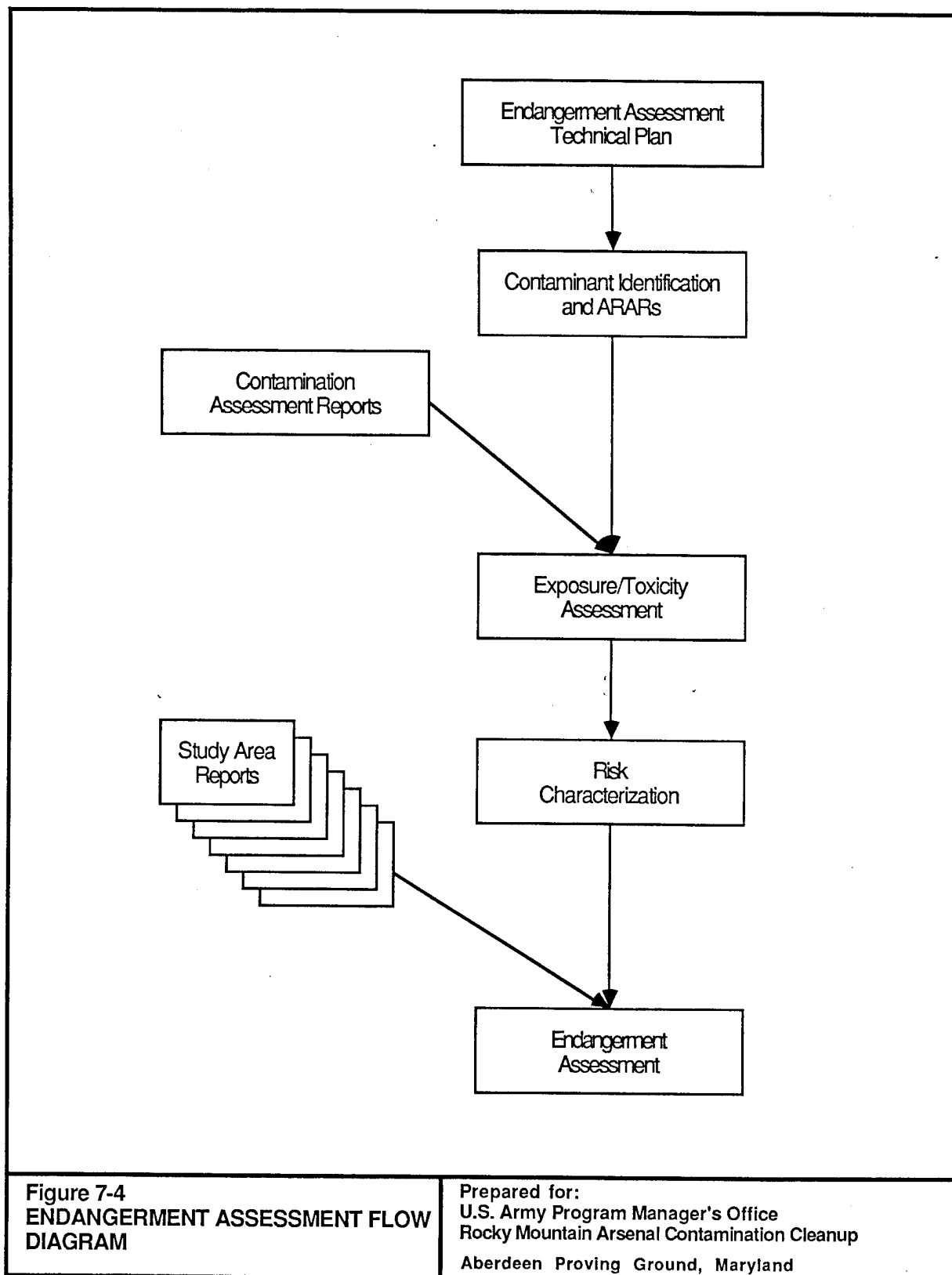
The critical path switches from the EA to the FS at the Evaluation of Alternatives (EOA) step. The critical dates are as follows:

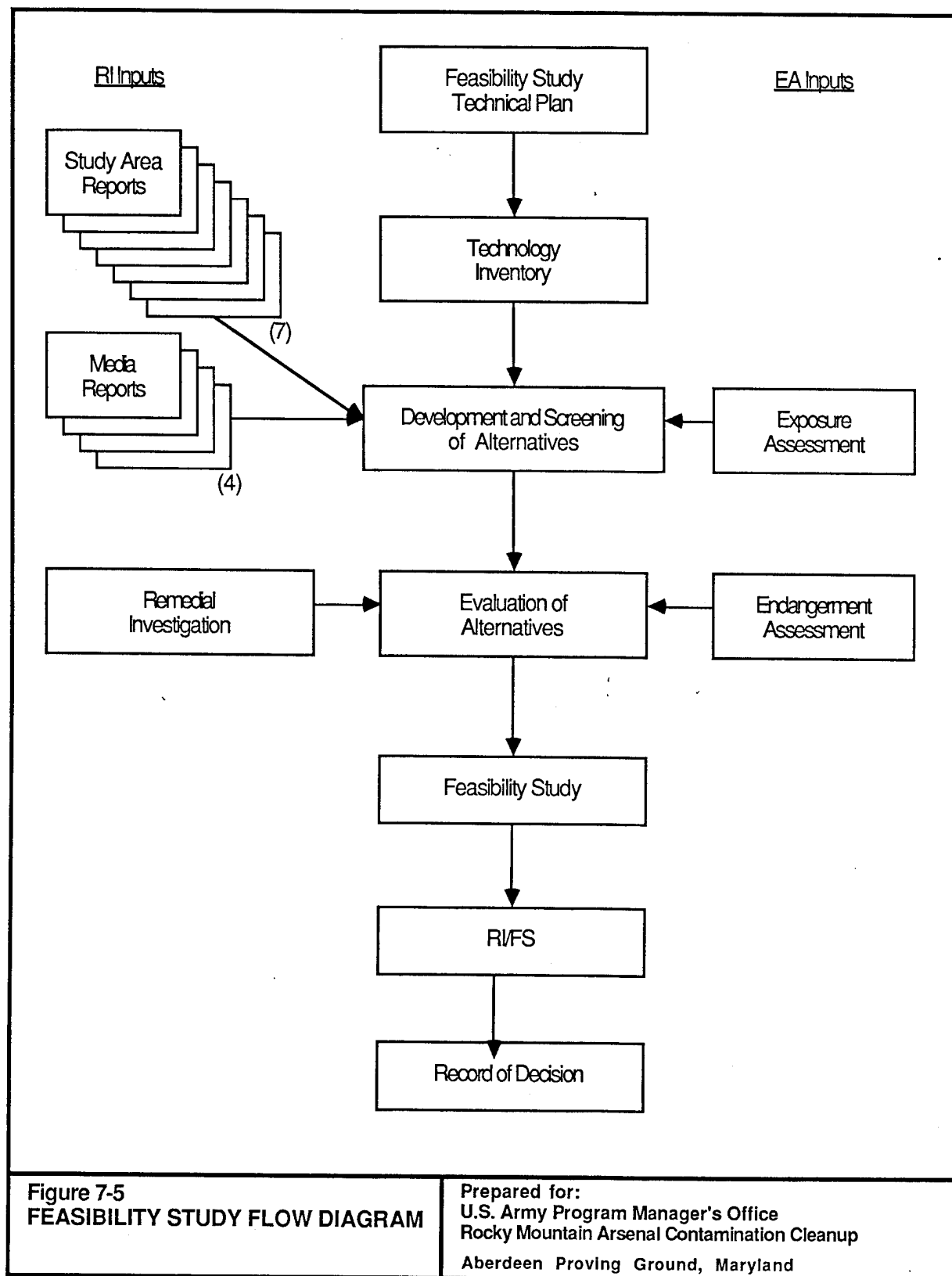
PRODUCT	DATE
Development/Screening of Alternatives	17 Jul 90
Evaluation of Alternatives	10 Apr 91
FS with Preferred Alternative	1 Feb 92

7.5 OFFPOST

The offpost program has a separate ROD and is substantially different than the onpost RI/FS. The program contains two Products and one Subproduct (refer to Figure 7-2).

The most important structure difference is that the RI and the ARAR determination have been combined, as have the EA and FS Reports. Also significant is the much smaller size of the program, which allows for single Product review rather than the series of Product and Subproducts found in the onpost program. The critical dates are as follows:





**Figure 7-5
FEASIBILITY STUDY FLOW DIAGRAM**

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

PRODUCT
RI Report with EA ARARs
FS with Preferred Alternative and EA

DATE
5 June 88
29 Mar 89

Note that these dates do not include dispute resolution.

7.6 INTERIM RESPONSE ACTIONS

The IRA process that is described in the consent decree is displayed by Figure 7-6. There are currently 12 IRAs included in the program. Two original IRAs for the South Adams County Water Treatment System were turned over to the SACWSD following the signing of an agreement with the Army, EPA, Colorado, and SACWSD on October 30, 1987.

The IRA schedule is separate from the RI/FS program because of the capacity limitations of the MS Project software. The IRAs are independent of each other and therefore no slack is displayed.

Three IRAs, Basin F, Abandoned Wells, and Fugitive Dust, have a slightly different structure than the others as described in the consent decree. In general, these IRAs have been expedited by removing dispute resolution opportunities.

The critical dates are as follows:

<u>IRA DECISION DOCUMENT</u>	<u>DATE</u>
GW System North of RMA	7 Oct 88
Improve North Boundary System	21 Dec 88
Basin F GW System	15 Oct 88
Abandoned Well Closure	8 Apr 88
Basin A Neck GW System	8 Nov 88
Basin F Removal	15 Mar 88
Building 1727 Sump	7 Oct 88
Hydrazine Facility	8 Aug 88
Fugitive Dust	NA (exempt)
Sanitary Sewer Removal	5 Jan 89
Asbestos Removal	NA (exempt)
Hot Spot Removal	15 Jun 91

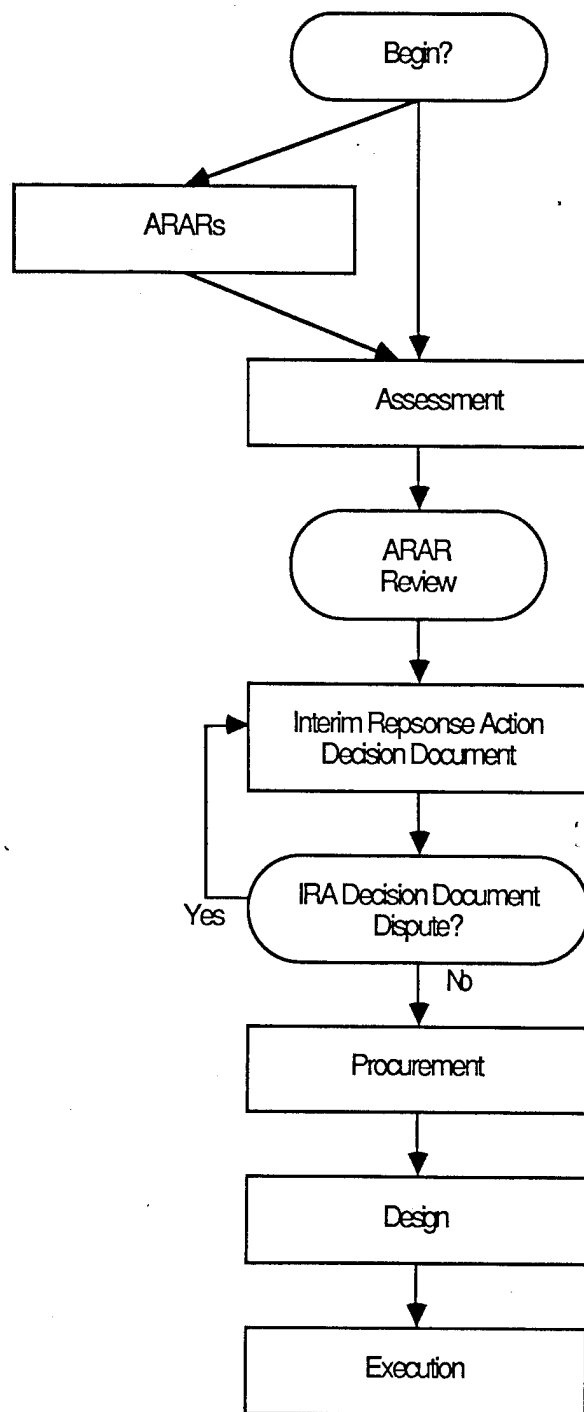


Figure 7-6
INTERIM RESPONSE ACTION FLOW
DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

APPENDIX A
TASK SUMMARIES

RI SUMMARIES

RI SUMMARY

Task Number: Not Applicable Date: 12/03/87
Task Name: Offpost Remedial Investigation
PMO Contact: Charlie Scharmann
Medium: Biota, Surface Water, Ground Water, Soil
Award Date: August 1984
Budget: \$1.6 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

The Offpost RI was designed to determine the persistence and rate of movement of RMA contaminants offpost (see figure) along pathways that could lead to significant human exposure. The pathways investigated include: ground water, surface water, soil, and biota. The investigative techniques employed attempted to quantify the amount and variety of contaminants present in each pathway and assess the risk to the indigenous population potentially affected. The completed study will be used to determine whether offsite remedial actions are required, and, if so, provide an adequate data base for the development of remedial action alternatives.

Scope-of-Work

The overall scope-of-work can be delineated into five programs:

- 1) Consumptive Use Sampling Phase I.
- 2) Consumptive Use Sampling Phase II.
- 3) Monitor Well Installation and Sampling, Surface Water Sampling.
- 4) Biota Monitoring.
- 5) Long-term Monitoring.

The first phase of consumptive use well sampling investigated 117 alluvial and Denver Formation wells offpost. These wells were all located within projected ground water contaminant plumes migrating offpost and primarily used for domestic or commercial water supply. Water samples were collected from each well in January and February 1985 and analyzed for organochlorine pesticides, organosulphur compounds, volatile organics, organophosphorus compounds, chloride, and fluoride.

The second phase of consumptive use well sampling was performed in September and October 1985. Forty alluvial and Denver Formation wells were sampled. Wells selected for this phase of sampling were located in areas of high level contamination identified during Phase I. Most of the wells sampled during Phase II had not been sampled during Phase I. All Phase II samples collected were analyzed for Phase I analytes.

Thirty ground water monitoring wells were installed. Twenty-nine wells (28 alluvial and 1 Denver Formation) were drilled in the Offpost Contamination Study Area north and northwest of RMA, and one shallow alluvial background well was emplaced near the southwest corner of RMA.

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All wells were installed and constructed to maximize the probability of obtaining representative hydrogeologic data, intercepting contaminant plume(s), and determining the interrelationships between irrigation ditches, surface water, alluvial ground water, and Denver Formation ground water. During well installation, selected sediment samples were analyzed for physical properties including: grain size, moisture content, and plasticity. Completed wells were slug tested to determine aquifer characteristics.

After completion and development, each well and 11 surface water sites were sampled for water quality analysis. The analytical suite was the same as that for consumptive use wells described above. Two quarterly sampling programs were performed.

Cottontail rabbits and ring-necked pheasants were targeted as species of concern for biota monitoring as individuals migrating offpost may be captured and eaten. Field crews began capturing and marking rabbits and pheasants onpost in mid-summer 1985. Pheasants were captured at night. Age, sex, date of capture, and precise location was recorded for each bird. Each bird was marked with a non-toxic dye and selected birds were fitted with radio transmitter. Rabbits were captured using live traps. The sex, age, date of capture, and precise location were noted for each individual. In addition, all rabbits trapped were marked with metal ear tags and/or non-toxic dye. Recapture and resight studies were performed in September and October 1985. Resight studies consisted of walking along transects through the biota study area and identifying and locating individual rabbits or pheasants encountered. In addition, radiotracking of several individuals was performed. This program was repeated in January and February 1986.

The 30 offpost monitoring wells installed during this task and 43 wells incorporated by the Army, state, and county departments into the 360° Monitoring Program now comprise a network of wells designated for long-term monitoring of contaminant migration offpost. These wells will be included in the Task 39 RI/FS.

Consultants

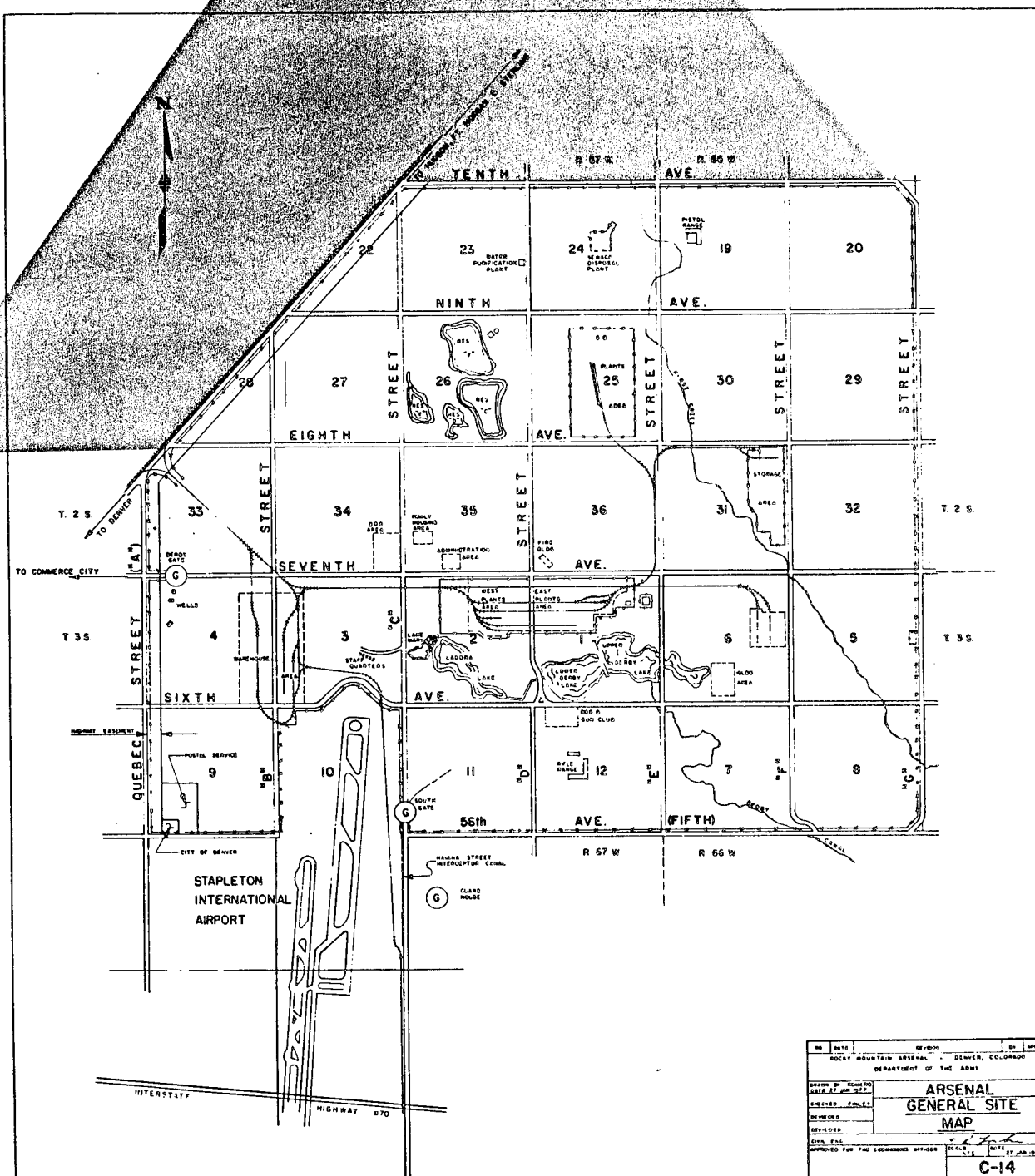
MRI - chemical analysis

D.P. Associates - litigation/documentation support

Arrow Drilling - drilling/well installation

ITECH - surveying

Reports	RIC #	Date Produced
Monitor Well Locations for the Geotechnical Program	87016R11	5/85
New Well Siting Report	87016R12	7/85
Technical Plan	87016R04	08/85
Consumptive Use - Phase I Report	87016R02	10/85
Revision III - 360° Monitoring Program Report	87016R05	2/86
Ground Water Flow and Contaminant Transport Models	87016R10	2/86
Consumptive Use - Phase II Report	87016R03	8/86
Contamination Assessment Report Draft Final	87202R01	4/87



12/03/87

RI SUMMARY

Task Number: 1 **Date:** 12/03/87
Task Name: Section 36 Contamination Assessment - Phases I and II
PMO Contact: Darryl Borrelli
Medium: Soils
Award Date: September 1984
Budget: \$4.8 million with modifications
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Phase I investigated the extent of contamination in Section 36 soils, specifically for Shell and joint sites. Phase II is revisiting most of these areas, the boundaries of which were revised based on Phase I data. Phase II investigation will further define the extent of contamination and estimate the volume of contaminated soil in Section 36 (see figure). It will penetrate the saturated zone in selected areas, and include soil/water analyses for determination of partition coefficients (K_d).

Scope-of-Work

Task 1 incorporates a Phase I and II Remedial Investigation. It includes a soils survey of Section 36 on the Rocky Mountain Arsenal (RMA) which involves sampling 14 identified sites (36-1, 36-3, 36-4, 36-5, 36-7, 36-8, 36-10, 36-11, 36-12, 36-17, 36-20, 36-21, and 36-22), and the uncontaminated area of Section (36-UNC). Chemical analyses were performed on samples for organic and inorganic (metals) analytes.

There were 435 samples taken from 207 borings during Phase I. During Phase II, 853 samples will be taken from 435 borings. Twelve wells are being installed for the long-term network and soil/water samples were taken for K_d investigation. Five additional borings are being performed to support the K_d investigation.

The samples are being analyzed for the standard Phase I compounds including: ICP metals, mercury, arsenic, semivolatile and volatile organics (GC/MS), and DBCP (GC). Analytical parameters for Phase II soil samples are organochlorine pesticides (GC/EC), organophosphorus pesticides (GC/NPD), mercury and arsenic (AA), ICP metals, organosulfur compounds (GC/FP), organophosphorus compounds (GC/FPD), hydrocarbons (GC/FID), volatile aromatic compounds (GC/PID), volatile halogenated compounds (GC/CON), and Army agent degradation products in suspect areas.

Consultants

Harding Lawson Associates (HLA)	- field work, report preparation
Midwest Research Institute (MRI)	- chemical analyses
FOX	- drilling
ITECH	- surveying

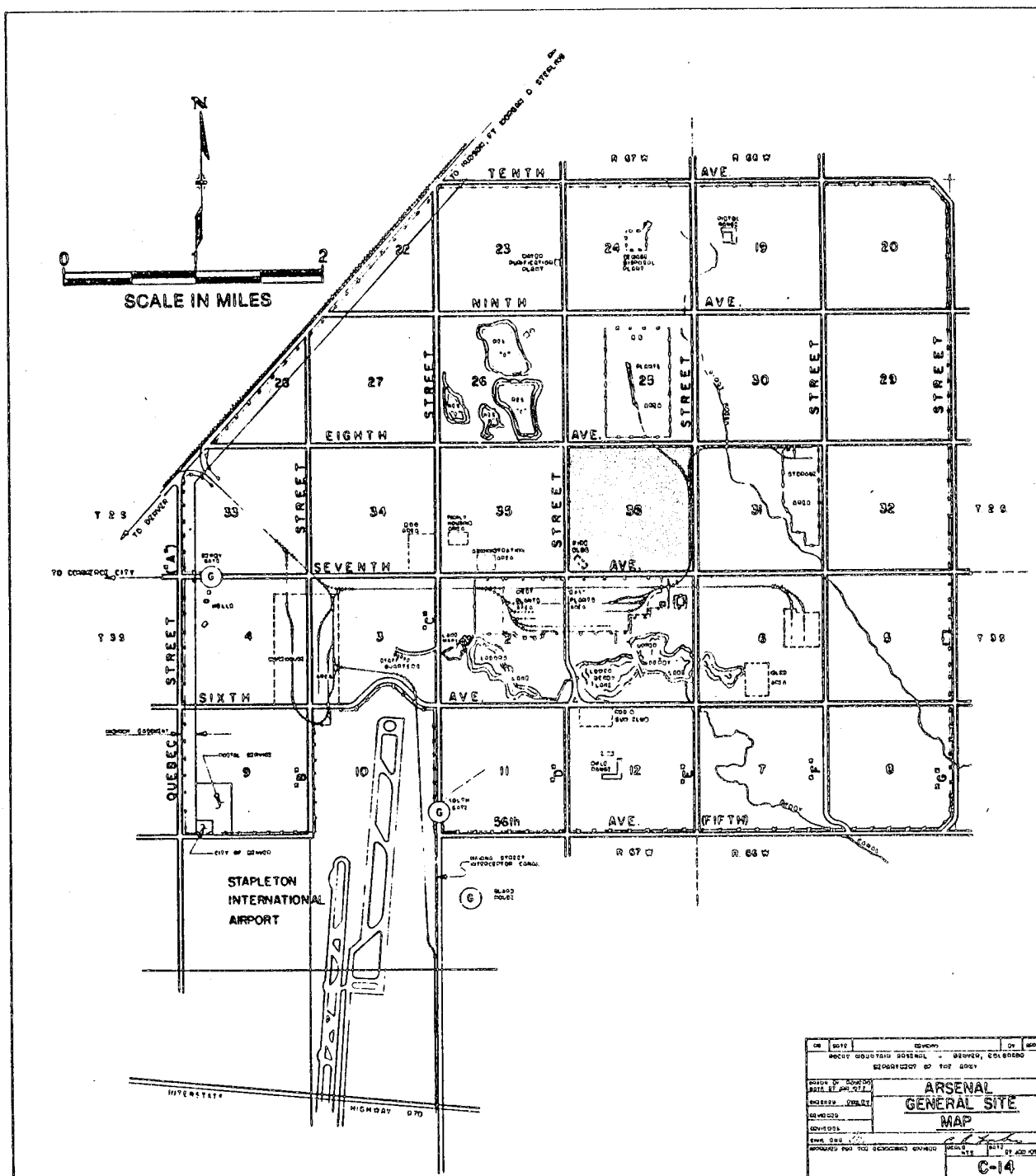
Reports	RIC #	Date Produced
Technical Plan, Final	85127R07	06/85
Field Actions Taken by Contractor for Detection of Chemical Agents		08/87

Contamination Assessment Reports - Phase I:

Site	Name		
36-1	Basin A	87203R07	07/87
36-3	Insecticide Pits	87203R01	06/87
36-4	Lime Settling Basins	87203R02	06/87
36-7	Solid Waste Burial		
	Sanitary Pits	87014R22C	ongoing*
36-8	Chemical Drainage Ditches	87113R01	04/87
36-10	Pit		ongoing*
36-11	Liquid Storage Pool	87133R01	05/87
36-12	Pits/Trenches		ongoing*
36-15	Burning Sites	87203R03	07/87
36-17	Complex Disposal Activity	87014R21C	ongoing*
36-20	Chemical Sewer	87133R02	04/87
36-21	Drainage Ditch	87133R03	04/87
36-22	Liquid Storage Pool		ongoing*
36-UNC	Section 36-Uncontaminated Areas	87014R21A	ongoing*

Contamination Assessment Reports, Phase II Addenda ongoing

* - Draft Final



TASK 1 STUDY AREA

RI SUMMARY

Task Number: 2 Date: 11/02/87
Task Name: South Plants Contamination Assessment - Phase I and II
PMO Contact: Darryl Borrelli
Medium: Soils, structures
Award Date: October 1984
Budget: \$4,201,560
Prime Contractor: Ebasco Services, Inc.

Objectives

Phase I investigated the extent of soils contamination in sources in the South Plants area of Sections 1 and 2. Phase I also investigated a limited number of South Plants buildings for their potential as contamination sources. Phase II is revisiting most of these areas, boundaries of which may have been revised based on Phase I data. Phase II investigations will further define the extent of contamination and estimate the volume of contaminated soil.

Scope-of-Work

Task 2 incorporates a Phase I and II Remedial Investigation. It includes a soil survey of Sections 1 and 2 on the Rocky Mountain Arsenal which involves sampling 19 identified sources (1-3, 1-4, 1-5, 1-8, 1-10, 1-11, 1-13, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, 2-12, 2-13, 2-14, 2-18) and a Regional Study throughout areas of the manufacturing complex which were not specifically designated by a source number, and chemical analyses of these samples for organic and inorganic (metals) analytes.

Soil in Sections 1 and 2 is being investigated to determine the extent of contamination. 263 Phase I borings were completed and an estimated 119 Phase II borings will be drilled. A soil gas survey to investigate the source of a benzene plume (Sites 2-2, 2-13, and 1-10) will be performed.

Task 2 also includes the compilation of historical information regarding activities in 89 buildings in Sections 1 and 2, and limited dust sampling and reconnaissance of these buildings.

The soil samples are being analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, mercury, and arsenic. Analytical parameters for Phase I building (composite dust) samples include semivolatile organics (GC/MS), asbestos, ICP metals, mercury, and arsenic. Analytical parameters for air monitoring samples obtained in buildings are volatile organics (GC/MS). Analytical parameters for Phase II soil samples are organochlorine pesticides (GCEC), organophosphorus pesticides (GCNPD), mercury and arsenic (AA), ICP metals, organosulfur compounds (GCFP), organophosphorus compounds (GCFPD), hydrocarbons (GC/FID), volatile aromatic compounds (GCPID), volatile halogenated compounds (GCCON), and Army agent degradation products in suspect agent areas.

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Consultants

R.L Stollar and Associates	-	field work, reports
Geraghty and Miller	-	field work
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Technos, Inc.	-	geophysics
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	87006R01	08/85
Procedures Manual, Vol. 1	86241R01	08/85
Procedures Manual, Vol. 2	86241R02	08/85
Procedures Manual, Vol. 3	87006R02	08/86
Procedures Manual, Vol. 4	86241R04	08/85
Regional Study Technical Plan	87275R01	12/86

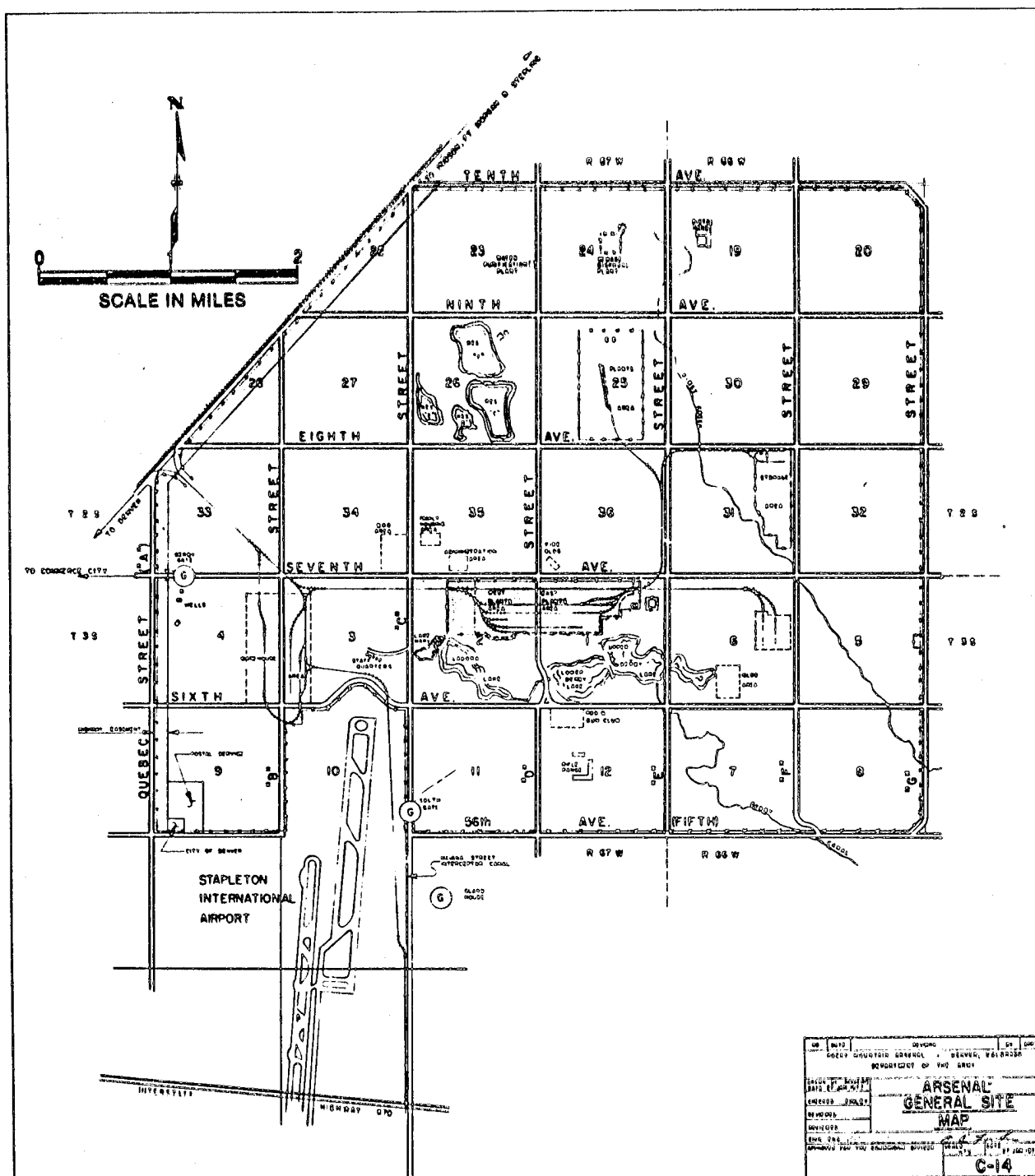
Contamination Assessment Reports:

<u>Site</u>	<u>Name</u>	<u>RIC#</u>	<u>Date Produced</u>
1-3	Mounded Area	87097R09	04/87*
1-4	Borrow Pit	87097R08	04/87
1-5	Lime Pits	87006R15	02/87
1-8	Salvage Yard	87127R05	05/87
1-10	South Tank Farm	87127R01	04/87
1-11	Sanitary Landfill	87216R01	07/87
1-13	So. Plants Mfg. Area - Spills		ongoing
2-2	Test Site	87216R02	07/87
2-3	Lagoon	87006R16	02/87
2-4	Excavation Pit	87006R17	02/87
2-5	Trench	87216R03	07/87
2-6	Salt Storage Pad	87127R02	04/87
2-7	Aeration Basin	87006R18	02/87
2-8	Former Tank Storage		ongoing
2-9	Open Storage Area	87006R19	02/87
2-12	Revetted Tank Storage Area	87006R20	02/87
2-13	Open Storage Area	87216R04	07/87
2-14	Sanitary Landfill	87216R05	07/87
2-18	So. Plants Mfg. Area - Spills		ongoing

* - draft final

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TASK 2 STUDY AREA

RI SUMMARY

Task Number: 4 **Date:** 12/03/87
Task Name: RMA Water Quantity/Quality Survey
PMO Contact: Charlie Scharmann
Medium: Water
Award Date: May 13, 1985
Budget: \$3.7 million with modifications
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

- Under this task a one year ground water and surface water surveillance program will be performed at RMA to achieve the following objectives:
- o Satisfy compliance oriented regulatory requirements under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Resource Conservation and Recovery Act (RCRA) and the intent of the Cease and Desist Order;
 - o Confirm the existence and chemical nature of known contamination and monitor any changes in the lateral and vertical extent of contaminant migration; and
 - o Develop a core data base for use in upcoming litigation and RI/FS analyses for RMA.

Scope-of-Work

The purpose of the Task 4 Water Quantity/Quality Survey is to execute a one-year ground water and surface water surveillance program capable of satisfying the various regulatory requirements, developing a litigation quality data base, and verifying the extent and nature of known contamination. In order to achieve these objectives, five distinct technical elements are anticipated. These are as follows:

- o Review historical data;
- o Develop a monitoring program to achieve the above objectives;
- o Execute the monitoring program utilizing litigation quality sampling and analytical procedures;
- o Assess data quarterly for possible adjustments in the monitoring program; and
- o Compile the accumulated data at the end of the one-year program.

Currently there are over 2,000 monitoring wells on RMA. During the review of historical data, a large number of these wells were evaluated with respect to construction detail, sampling history, and location. Criteria for evaluating these wells are described in Sections 3.1.1.1 through 3.1.1.3 of the Task 4 Technical Plan (RIC#87013R01).

Based on the results of the review of historical data, a monitoring program was designed, resulting in an extensive Initial Screening Program. Based on an evaluation of the results obtained during the Initial Screening Program, the proposed monitoring program for the third and fourth quarters was designed and implemented.

All ground water monitoring wells and surface water sampling sites will be sampled using uniform sampling methodologies. Ground water and surface water samples will be analyzed for a predetermined list of analytes including numerous organic and inorganic parameters. Sample collection, measurement of field parameters, and analysis of samples will be performed in accordance with USATHAMA Quality Assurance/Quality Control procedures. These procedures include collection of field quality control samples and decontamination of all sampling equipment.

All studies under this task were performed in accordance with the requirements and technical specifications discussed in Section C-3 and Appendices A [U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Quality Assurance Program, 1982] and B (USATHAMA Geotechnical Requirement, 1983), except where modified as required for technical/litigation standardization. Standardized methods, protocols, and criteria will be consistent with those proposed in Tasks 1 and 2, and as standardized during subsequent meetings between the government and contractors. Services will consist of collection, analysis, reduction, and compilation of environmental data for both surface and ground water. Data will be collected during a 12-month period and will include stream flow, ground water level, and water quality evaluations. Acquired data will be utilized as input into the litigation effort.

Consultants

HLA - technical support-ground water
RCI - technical support-surface water
ITECH - surveying

Reports	RIC_#	Date Produced
Technical Plan, Final	87013R01	09/86
Initial Screening Program Report	87253R01	08/87
Final Screening Program Report		ongoing

RI SUMMARY

Task Number: 6 Date: 12/03/87
Task Name: Sections 26 and 35 - Phase I
PMO Contact: Kevin Blose
Medium: Soil
Award Date: April 30, 1985
Budget: \$1.16 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

The objectives of this task included the development and execution of a Phase I soil RI for sites contained within Sections 26 and 35 (see figure) on RMA. This investigation was to provide site-specific physical and chemical information to base Phase II surveys, which will further define chemicals present and the estimate volumes of soil affected.

Scope-of-Work

The scope-of-work of this task included a detailed historical records search to develop a picture of the past use of Sections 26 and 35 at RMA. A detailed Technical Plan outlining the remedial investigation of eight sites was developed. These sites were designated as 26-1, 26-3, 26-4, 26-5, 26-6, 26-7, 35-3, and 35-4. The sites investigated included unlined and lined waste basins and other various ditches, as well as the undisturbed areas of Sections 26 and 35 (26-UNC and 35-UNC).

A total of 441 soil samples were collected from 220 borings. The samples were analyzed for a standard target list of Phase I compounds including: volatile and semivolatile organics by GC/MS; nemagon (DBCP) by GC; cadmium, copper, lead, and zinc by ICP; as well as arsenic and mercury. In addition to the target organic compounds, all nontarget organic compounds found to be present were tentatively identified and their concentrations estimated. Geophysical techniques were also employed to ensure boring sites were clear of metal debris before drilling began.

Consultants

HLA - field support, geophysics, report preparation, general support
ITECH - surveying
MRI - chemical analyses
FOX - drilling

Reports

RIC_#

Date_Produced

Technical Plan, Draft Final

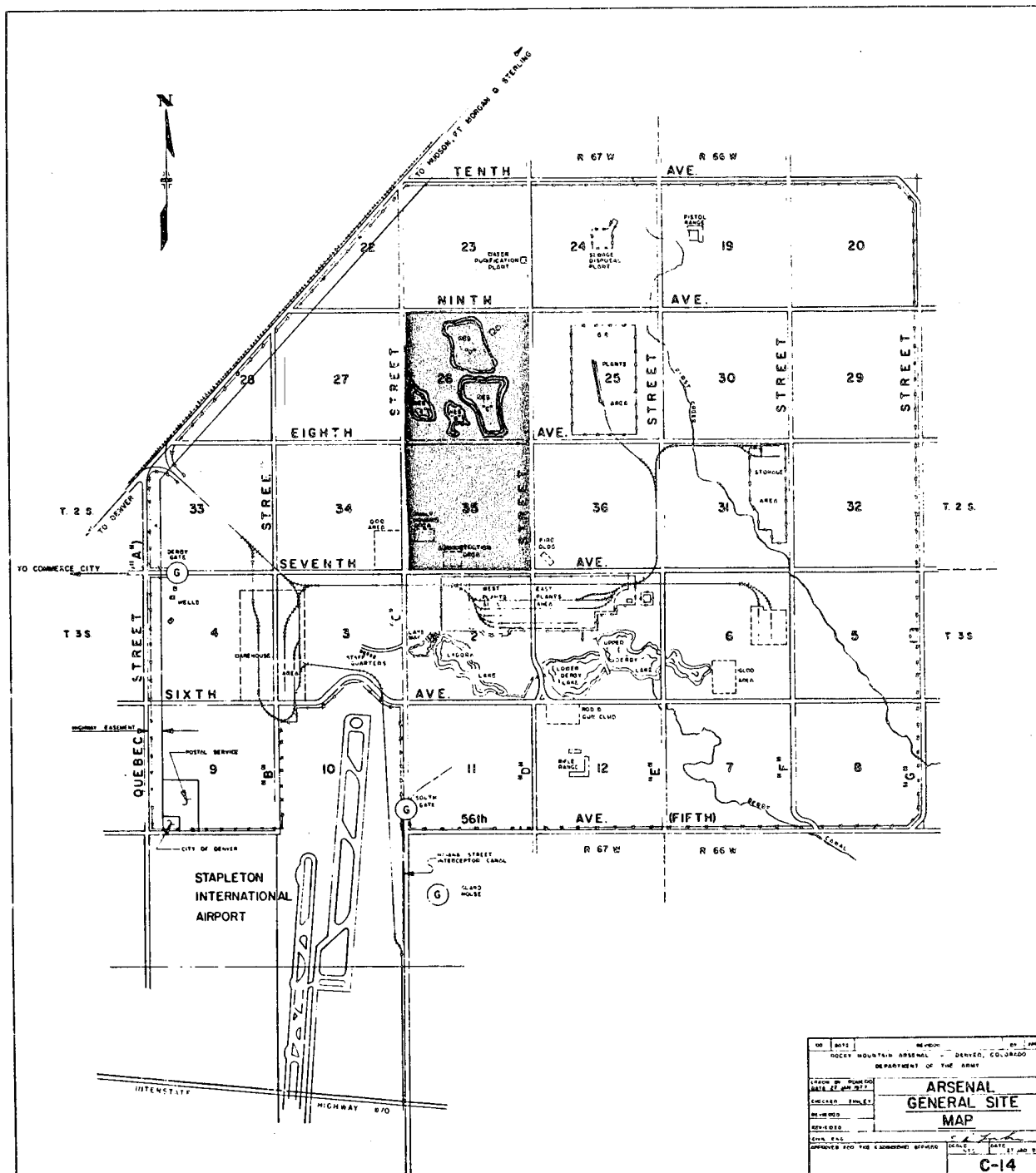
86238R05

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Contamination Assessment Reports - Phase I:

Site	Name		
26-1	Deep Injection Well	87114R01	10/86*
26-3	Basin C	87014R19	10/86*
26-4	Basin D	87014R15	8/86*
26-5	Basin E	87014R16	8/86*
26-6	Basin F	87104R23	10/86*
26-7	Basins B & C Drainage Ditch (combined with 35-4)	87114R02	3/87*
35-3	Basin B	87014R18	8/86*
35-4	Basin A Drainage Ditch	87114R02	3/87*
26-UNC	Section 26-Uncontaminated Areas	87014R14	8/86*
35-UNC	Section 35-Uncontaminated Areas	87014R17	8/86*

* - Draft Final



TASK 6 STUDY AREA

RI SUMMARY

Task Number: 7 Date: 11/02/87
Task Name: Lower Lakes - Phase I Contamination Assessment
PMO Contact: Juan Lopez
Medium: Soils, sediment
Award Date: April, 1985
Budget: \$1,374,852
Prime Contractor: Ebasco Services, Inc.

Objectives

Phase I investigated the extent of soils contamination at miscellaneous sites in Sections 1, 2, 3, 24, and 30. Phase I also investigated the extent of sediment contamination in Lakes Mary and Ladora. Task 7 comprises Phase I work only.

Scope-of-Work

Task 7 is a Phase I remedial investigation task. It includes soil and sediment surveys in miscellaneous sections of Rocky Mountain Arsenal which involves sampling 10 identified sources (1-1, 1-9, 2-1, 2-17, 3-2, 3-3, 3-4, 24-6, 24-7, 30-4) and 2 uncontaminated areas (UNC-1, UNC-2). These sites are lakes, drainage ditches, open storage areas, landfills, and a sewage treatment plant.

Soils and sediments in these areas will be investigated to determine the magnitude and extent of contamination in source and uncontaminated areas covered under Task 7. 250 borings were drilled. Task 7 also included a compilation of all historical activities occurring in the subject areas, which were used in the development and refinement of sampling strategies.

The soil samples are being analyzed for the standard Phase I compounds, including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, and mercury and arsenic (AA).

The results of the Phase I investigation will be analyzed in a manner upon which to base the Task 20 Phase II investigations.

Consultants

R.L Stollar and Associates	- field work, reports
Custom Auger	- drilling
DataChem	- chemical analyses
Enseco-CAL	- chemical analyses
Technos, Inc.	- geophysics
ITECH	- surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	86238R02	02/86

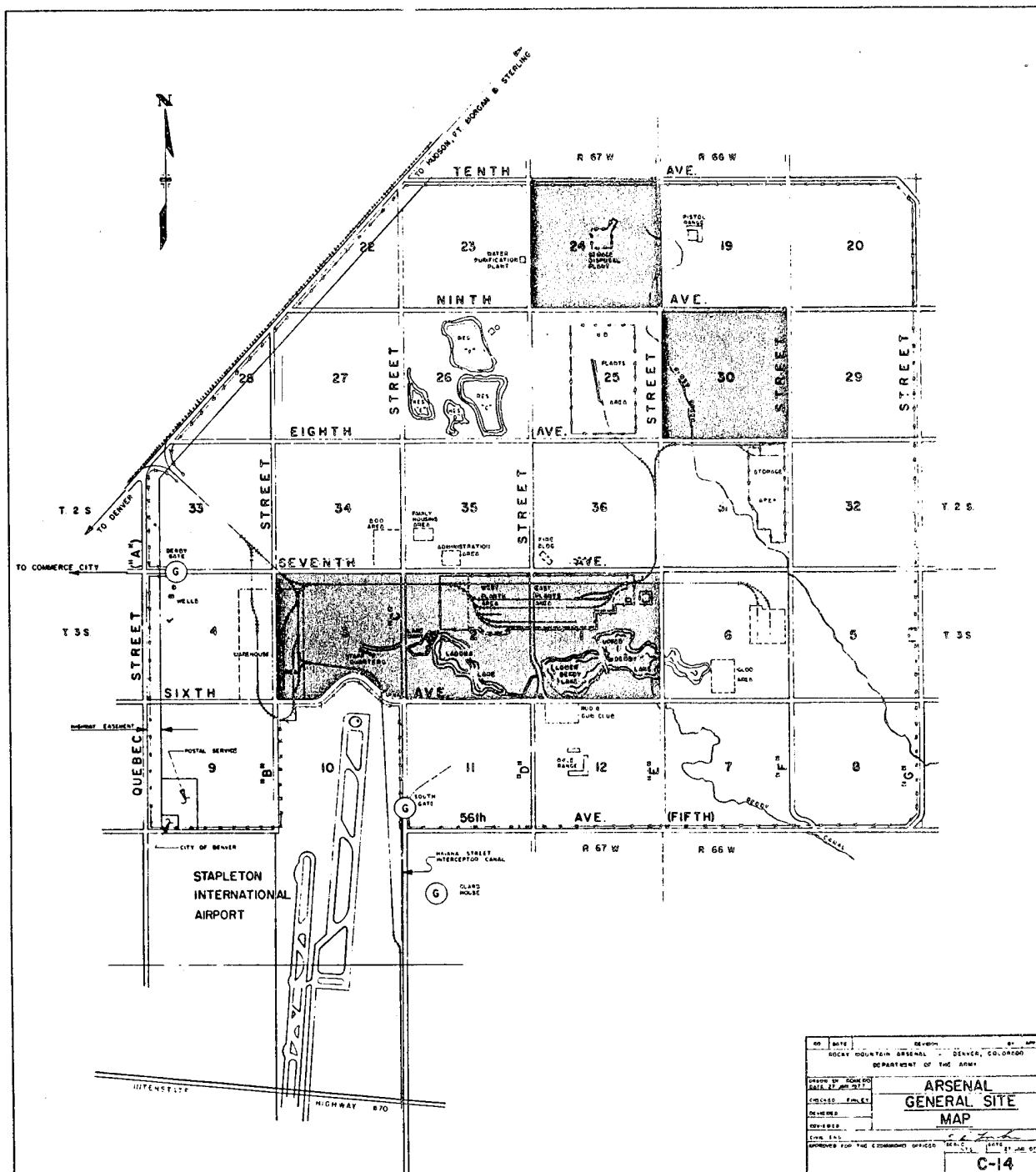
Contamination Assessment Reports:

<u>Site</u>	<u>Name</u>	<u>RIC#</u>	<u>Date Produced</u>
1-1	Drainage Ditches	87196R01	05/87
1-9	Open Storage Area	87127R07	05/87
2-1	Drainage Ditches	87216R06	07/87
2-17	Lakes Ladora and Mary	87216R07	07/87
3-2/3-3	Drainage Ditch and Overflow Basin	87197R01	05/87*
3-4	Nemagon Spill Area		09/87*
24-6	Sewage Treatment Plant	87216R08	07/87
24-7	North Bog	87097R10	04/87*
30-4	Sanitary Landfill	87216R09	07/87
1-UNC	Section 1, Uncontaminated Area	87127R06	04/87
2-UNC	Section 2, Uncontaminated Area	87127R08	05/87

* - draft final

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TASK 7 STUDY AREA

RI SUMMARY

Task Number: 9 **Date:** 12/03/87
Task Name: Biota Assessment - Phases I and II
PMO Contact: Andrew Kingery
Medium: Biota (Flora and Fauna)
Award Date: July 1985
Budget: \$1.60 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Phase I studies were designed to gather pertinent information on chemical contamination of plants and animals at RMA (see figure), to identify any data gaps, initiate the development of cleanup criteria, and to produce a summary report with scope-of-work for any additional field studies to be conducted in a later phase.

Phase II studies were designed to collect pertinent data on the chemical contamination in plants and animals at major sources of contamination, to identify pathways of contamination movement, continue the development of cleanup criteria in relation to plants and animals in natural ecosystems, and to produce a final biota report addressing RI topics for chemical contamination on and off of RMA.

Scope-of-Work

Phase I consisted of literature surveys, contacts with regional experts, a brief field reconnaissance survey, compilation of available information into a summary document, and the preparation of a Phase II study plan to fill data gaps identified in Phase I.

Phase II consists of several discrete subtasks designed to address data needs for the completion of the RI for biota in relation to contamination on and off of RMA. Additional investigations are considered as information from other tasks, primarily soil and water, to identify other potential sources of contamination for biota. The discovery of a winter roost for bald eagles on RMA in December 1986 precipitated intense studies of this endangered species in relation to RMA contamination, and in support of studies being conducted by the U.S. Fish and Wildlife Service (USFWS).

The combined workscope of Phase II studies includes the following subtasks:

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- o SITE CHARACTERIZATION--Quantitative vegetation studies and brief faunal surveys, including the collection of voucher specimens, are conducted at major sites of contamination and in onpost and offpost control sites to detect potential contaminant related effects. A vegetation map is being prepared showing the current distribution of vegetation types on RMA.
- o AVIAN REPRODUCTIVE SUCCESS--Field studies were conducted on RMA and at offpost control sites to evaluate contaminant related effects in mallards, pheasants, and kestrels. Eggs, fledglings, and adults were collected for subsequent contaminant analysis.
- o TISSUE ANALYSIS FOR CONTAMINANTS--Tissues were collected from key species of plants and animals for subsequent analysis for major contaminants of concern (dieldrin, aldrin, endrin, DDE, DDT, mercury, and arsenic). USATHAMA-certified methods were developed, and samples are being processed. Additional chemicals may be added, pending the development of additional data on the concentration and distribution of contaminants in Phase II water and soil tasks. Specimens for analysis include specimens of chance (e.g., raptors and larger mammal predators) found dead on and off of RMA.
- o ACETYLCHOLINESTERASE INHIBITION--Brains of animals collected for other contaminant analyses from sites of potential contamination and from control sites will be analyzed for evidence of acetylcholinesterase inhibition.
- o FOOD CHAIN DEFINITION--The gut contents from specimens collected for tissue analysis will be examined and identified to supplement data from the literature on food habits in order to provide a better data base for evaluating contaminants in regional food webs.
- o INVERTEBRATE POPULATION STUDIES--Population studies of earthworms, grasshoppers, and aquatic snails will be conducted at potential sites of contamination and in control areas.
- o PHYSICAL MALFORMATIONS--Any malformations in embryos or fledgling birds observed during the avian reproductive success subtask will be recorded and evaluated in relation to potential RMA contamination.
- o CRITERIA DEVELOPMENT--Pathways analyses will be conducted to identify and quantify food chains in terrestrial and aquatic food webs. These data will be used to evaluate the need for interim actions and site remediation, and for the development of possible site-specific cleanup criteria in relation to key species and major ecosystems on and near RMA.
- o DOMESTICATED PLANTS AND ANIMALS--Incidental information on potential pathways of contamination in domesticated plants and animals will be identified. This information will be provided to the appropriate Endangerment Assessment (EA) tasks for incorporation into human food chains.

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- o BALD EAGLE STUDIES--These investigations will be conducted in cooperation with the USFWS to study the timing, habitat use, food habits, and movement of bald eagles in relation to sites of known and potential contamination at RMA. Integration with offpost efforts is a part of this subtask.
- o BLACK-FOOTED FERRET SURVEYS--At the request of the USFWS, studies have been conducted at all prairie dog towns on RMA for black-footed ferrets by certified personnel using approved techniques.
- o PRAIRIE DOG PREY BASE STUDIES--Because prairie dogs support populations of burrowing owls, ferruginous hawks, Swainsons hawks, and bald eagles, the USFWS and MOA parties have requested a survey of the prairie dog prey base in relation to sites of contamination, the RMA proposed maintenance plan, interim cleanup actions, and future remediation.
- o ANALYSIS OF ADDITIONAL SAMPLES--Additional samples collected by the USFWS and others can provide additional data pertinent to the RI investigation and will be analyzed under this subtask.
- o AQUATIC SAMPLING--Additional sampling of biota in the Offpost Study Area may be collected for contamination analysis, pending the results of offpost water and sediment studies. This subtask will be scoped in coordination with the EA tasks.

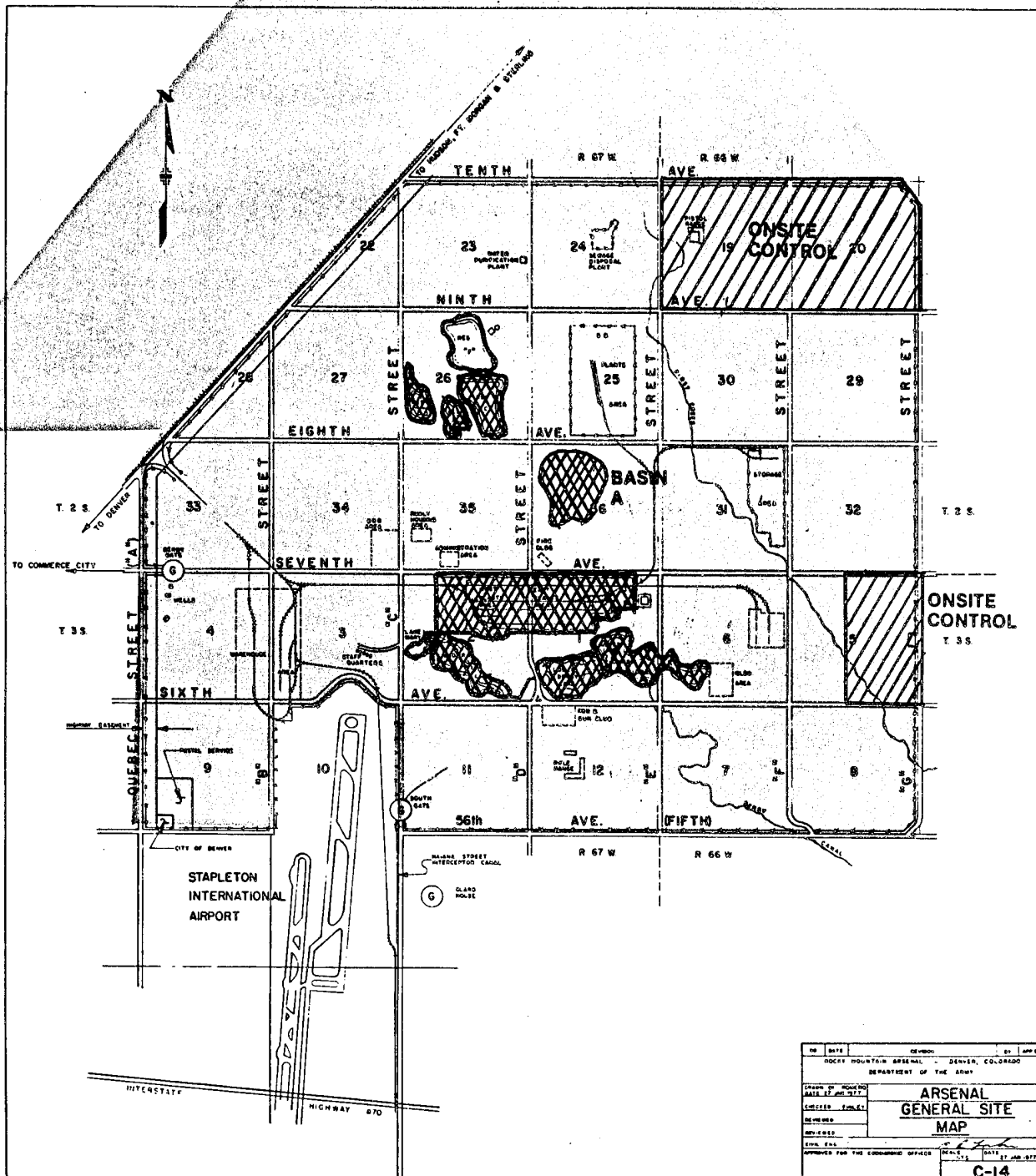
Consultants

Dr. Lowell McEwen (Colorado State University) - Avian Reproductive Success and Acetylcholinesterase Inhibition Subtasks.

Miscellaneous consultants for field study support.

Reports Produced	RIC #	Date
Phase I Technical Plan, Draft Final	86238R06	11/85
Phase II Technical Plan, Draft Final	86251R01	8/86
Phase I and Phase II Technical Plans, Final		8/87
Phase I Report		ongoing
Remedial Investigation Report on Biota		ongoing
Bald Eagle Reports		ongoing
Black-footed Ferret Report	87271R02	10/87*
Pathways Reports for Selected Contaminants		ongoing

* - One study report, serves as final document.



RI SUMMARY

Task Number:	10	Date:	11/02/87
Task Name:	Sewer Systems Investigation		
PMO Contact:	Kevin Blose		
Medium:	Soil		
Award Date:	September, 1985		
Budget:	\$1,040,727		
Prime Contractor:	Ebasco Services, Inc.		

Objectives

The purpose of this task is to investigate the soil contamination resulting from the use or misuse of the Rocky Mountain Arsenal chemical and sanitary sewer systems and the process water system. An assessment of the nature and extent of this contamination will be made.

The specific objectives are the following:

- o Determine which segments of the sanitary sewer system, the chemical sewer system, and the process water system are contaminated;
- o Identify specific and generic leak locations in the three systems; and
- o Evaluate the extent of soil contamination resulting from leaks in the system.

Scope-of-Work

Task 10 is investigating the potentially contaminated soil surrounding the sanitary and chemical sewer systems and the process water system. The areas being investigated include South Plants, North Plants, Administration Area, Rail Classification Yard, and connecting sections.

99 Borings were drilled along the 3 systems beneath manholes, in trenches along sections of pipe which had been dye tested, and near suspected leaks. 11 sediment samples were taken from inside manholes in the sanitary sewer system. Task 10 also includes the compilation of historical information regarding activities of the chemical and sanitary sewers and the process water system throughout the RMA.

The soil and sediment samples are being analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), ICP metals; arsenic and mercury (AA); thiodiglycol; and IMPA (HPLC).

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Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87007R38	10/86
Technical Plan, Final		ongoing
Contamination Assessment Reports:		
Sanitary Sewer - North Plants		ongoing
Sanitary Sewer - South Plants		ongoing
Sanitary Sewer - Interceptor Line		ongoing
Sanitary Sewer - Railyard and Administrative Areas		ongoing
Chemical Sewer System		ongoing
Process Water System		ongoing

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RI SUMMARY

Task Number: 11 Date: 11/02/87
Task Name: Hydrazine Blending and Storage Facility (HBSF)
Contamination Assessment
PMO Contact: Darryl Borrelli
Medium: Soils, water
Award Date: August, 1985
Budget: \$298,976
Company: Ebasco Services, Inc.

Objectives

The objective of Task 11 is to conduct a Phase I remedial investigation at Site 1-7, Hydrazine facility, to determine the nature and extent of contamination in soils and groundwater.

Scope-of-Work

Task 11 is a Phase I remedial investigation. It includes a soil survey of Site 1-7, a groundwater investigation, and chemical analyses of these samples for organic and inorganic (metals) analytes.

15 soil borings were drilled and sampled. Two groundwater monitoring wells were drilled and sampled. An additional 11 monitoring wells in the vicinity of the HBSF were sampled.

Soil samples were analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), ICP metals, mercury, arsenic, hydrazine, and nitrosamines. Water samples were analyzed for volatile and semivolatile organics (GC/MS), ICP metals, mercury, arsenic, hydrazines (GCNP), and nitrosamines (GCNP).

Consultants

Geraghty and Miller	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
ITECH	-	surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	86238R03	03/86
Contamination Assessment Report:		
<u>Site</u>	<u>Name</u>	<u>RIC#</u>
		<u>Date Produced</u>
1-7	Hydrazine facility	ongoing

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RI SUMMARY

Task Number: 12 Date: 11/02/87
Task Name: Derby Lakes Phase I Contamination Assessment
PMO Contact: Juan Lopez
Medium: Soils, sediments
Award Date: September, 1985
Budget: \$510,230
Prime Contractor: Ebasco Services, Inc.

Objectives

Phase I investigated the extent of soils contamination near the Derby Lakes area of RMA, in Sections 1, 6, 11, and 12. Phase I also investigated the extent of sediment contamination in Upper and Lower Derby Lakes, and Rod and Gun Club Pond. Task 12 comprised Phase I work only.

Scope-of-Work

Task 12 is a Phase I remedial investigation task. It includes a soil and sediment investigation in the Derby Lakes region of Rocky Mountain Arsenal. The following six sources were investigated under Task 12: 1-2, 1-12, 6-2, 11-1, 12-1, and 12-2. These sites are lakes, trash dumps, and buried lake sludge.

Soils and sediments in these areas will be investigated to determine the magnitude and extent of contamination in source areas covered under Task 12. 81 borings were drilled during the Phase I investigation. Task 12 also included a compilation of all historical activities occurring in the subject areas, which were used in the development and refinement of sampling strategies.

The soil samples are being analyzed for the standard Phase I compounds, including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, and mercury and arsenic (AA).

The results of the Phase I investigation will be analyzed in a manner upon which to base the Task 20 Phase II investigations.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
ITECH	-	surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	86238R01	02/86

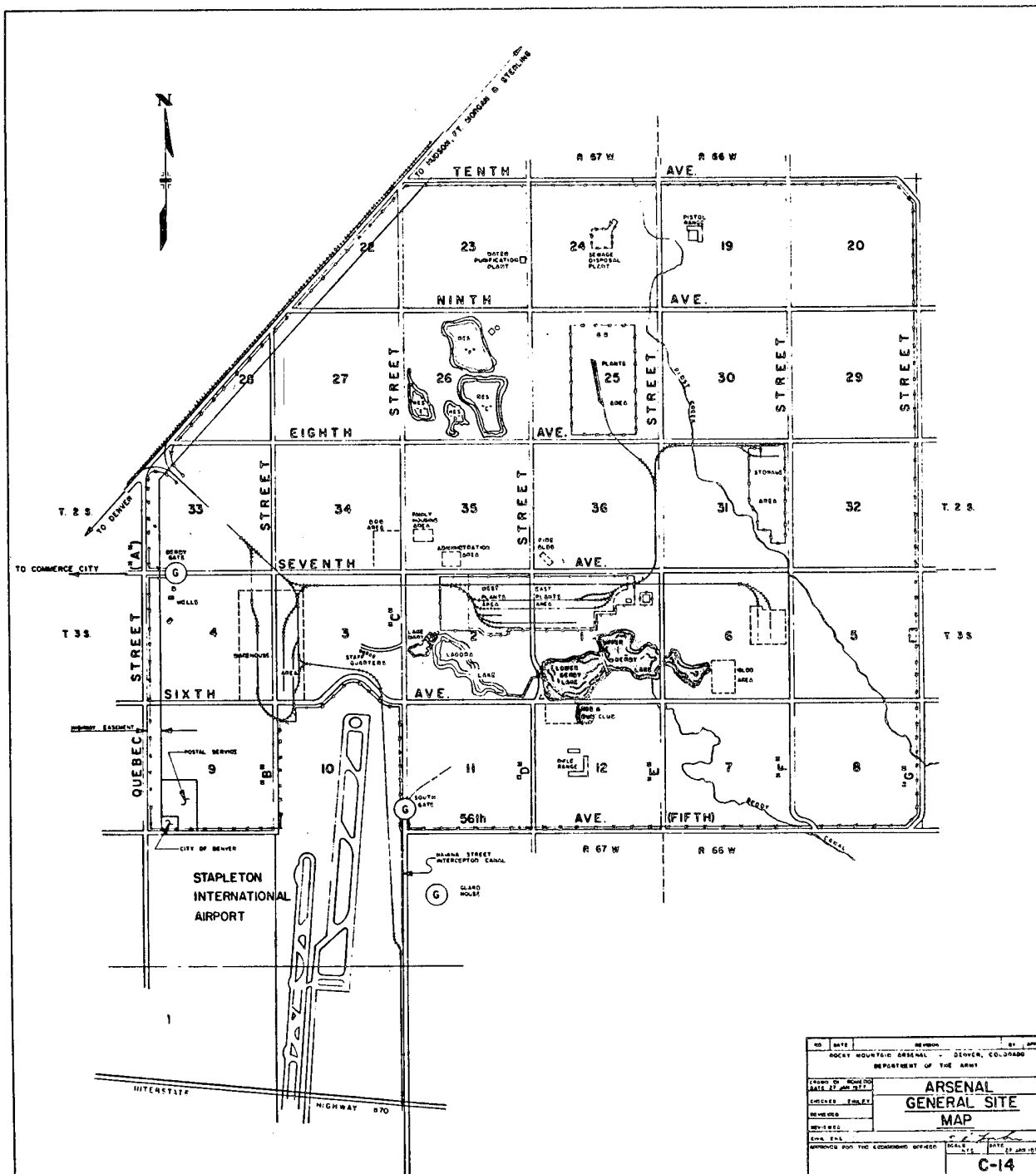
Contamination Assessment Reports:

<u>Site</u>	<u>Name</u>	<u>RIC#</u>	<u>Date Produced</u>
1-2	Upper and Lower Derby Lakes	87196R02	07/87
1-12	Trash Dump	87127R03	04/87
6-2	Eastern Upper Derby Lake	87196R03	06/87
12-1	Buried Lake Sludge	87197R02	05/87*
11-1	Buried Lake Sludge	87196R04	06/87
12-2	Rod and Gun Club Pond	87127R04	05/87

* - draft final report

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TASK 12 STUDY AREA

RI SUMMARY

Task Number: 14 Date: 12/03/87
Task Name: Army Sites North - Phase I
PMO Contact: Darryl Borrelli
Medium: Soil
Award Date: September 30, 1985
Budget: \$2.95 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

The objectives of the task included the development and execution of a Phase I soil remedial investigation for sites contained within Sections 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, and 36 on RMA (see figure). The investigation will provide site-specific physical and chemical information on which to base the development of any required Phase II survey, which will further define chemicals present and the estimated volumes of soil affected.

Scope-of-Work

The work on this task included a detailed historical records search to develop a picture of the past use of the 15 sections studied. A detailed Technical Plan outlining the remedial investigation was developed to study the 24 sites identified and 11 sections, thought to be undisturbed as determined from the records search. The sites investigated include areas designated as:

19-1	30-1	32-1	36-9
20-1	30-2	35-2	36-13
26-9	30-3	35-6	36-14
29-1	30-5	35-7	36-16
29-4	30-6	36-2	36-18
29-5	30-7	36-6	36-19

These sites included burn sites, burial sites, impact ranges, ditches, and miscellaneous ground scars. Also studied are areas designated as 19-UNC, 20-UNC, 22-UNC, 23-UNC, 24-UNC, 25-UNC, 27-UNC, 28-UNC, 29-UNC, 30-UNC, and 34-UNC.

A total of 1,031 soil samples were collected from 562 borings. The samples were analyzed for a list of Phase I analytes that included: volatile and semivolatile organics by GC/MS; nemagon (DBCP) by GC; cadmium, copper, lead, and zinc by ICP; as well as arsenic and mercury. In addition to the target compounds, all nontarget organic compounds found were tentatively identified and their concentrations estimated.

More detailed geophysics were performed at selected sites because of the ordnance that was burned or buried at the site. These techniques were used to complement the soil sampling to best define the areas where buried metal may be present.

Consultants

HLA - field support, geophysics, report preparation, general support
ITECH - surveying
MRI - chemical analyses
FOX - drilling

Reports

RIC #

Date Produced

Technical Plan, Draft Final

86238R04

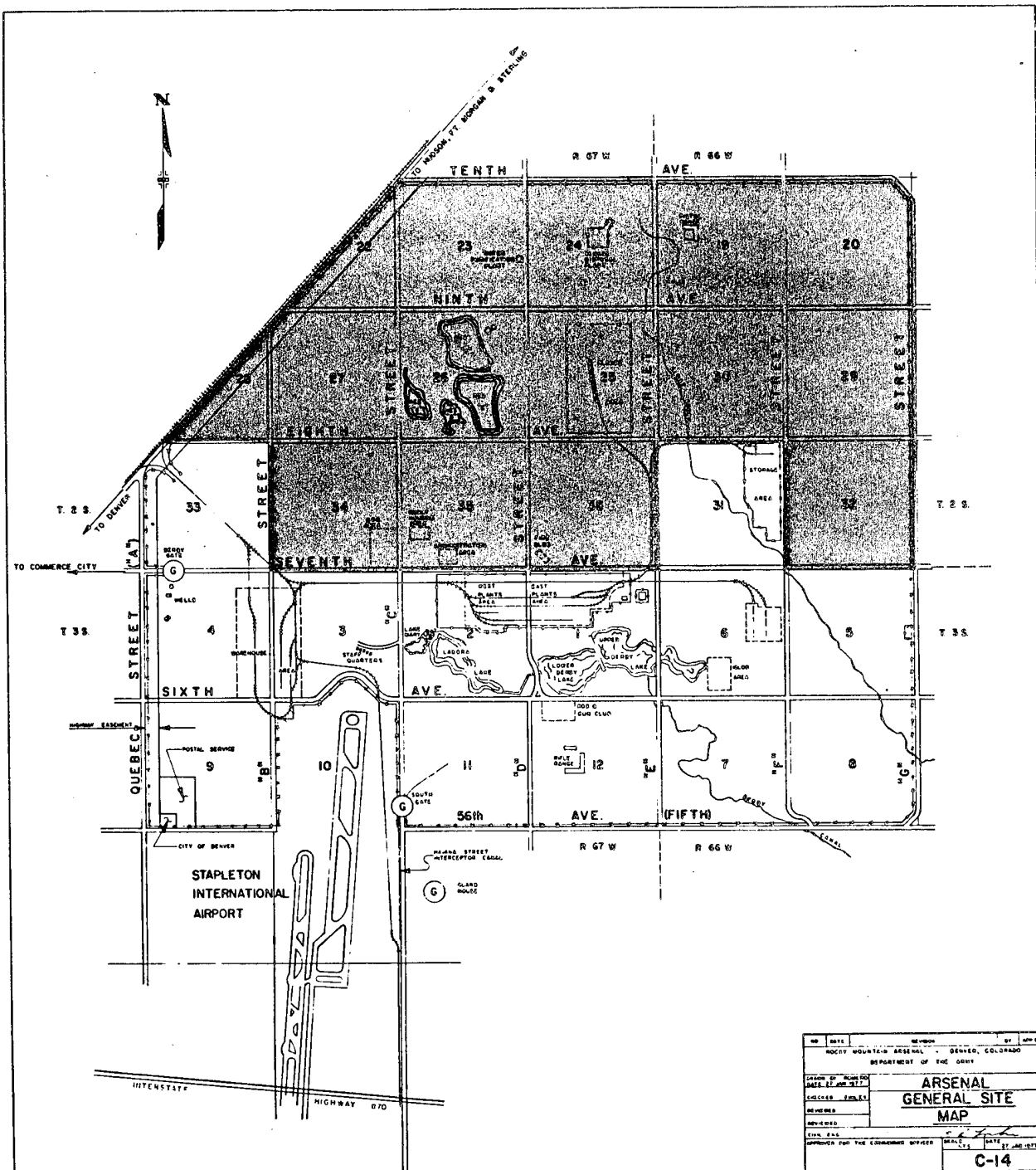
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Contamination Assessment Reports - Phase I:

Site	Name	
19-1	Burn Site, Incendiaries	03/87*
20-1	Burn Site, Incendiaries	03/87*
26-9	Chemical Sewer (combined with 35-2)	10/87*
29-1	Burn Site, Incendiaries	03/87*
29-4	Disposal Site for Explosives and Incendiaries	10/87*
29-5	Bomb Disposal Site	03/87*
30-1	Impact Area	04/87*
30-2	Burn Site, Incendiaries	03/87*
30-3	"H" Training Area	10/87*
30-5	M-34 Demilitarization Operations Area	06/87*
30-6	Liquid Disposal Trenches	04/87*
30-7	Ground Disturbances (combined with 30-1)	04/87*
32-1	Bomb Disposal Site (combined with 29-5)	03/87*
35-2	Chemical Sewer	10/87*
35-6	Possible Munitions Test Area	03/87*
35-7	Firing Range	10/87*
36-2	Munitions Test Area and Incendiary Drop Site	08/87*
36-6	Trenches	09/87*
36-9	Incendiary or Munitions Test Area	08/87*
36-13	Trenches	06/87*
36-14	Mustard Plant Disposal Site	08/87*
36-16	Incendiary Burial Site	08/87*
36-18	Possible Trench Disposal Site	09/87*
36-19	Grading Scars	06/87*
19-UNC	Section 19-Uncontaminated Areas	04/87*
20-UNC	Section 20-Uncontaminated Areas	08/87*
22-UNC	Section 22-Uncontaminated Areas	05/87*
23-UNC	Section 23-Uncontaminated Areas	08/87*

24-UNC	Section 24-Uncontaminated Areas	05/87*
25-UNC	Section 25-Uncontaminated Areas	09/87*
27-UNC	Section 27-Uncontaminated Areas	05/87*
28-UNC	Section 28-Uncontaminated Areas	05/87*
29-UNC	Section 29-Uncontaminated Areas	06/87*
30-UNC	Section 30-Uncontaminated Areas	06/87*
34-UNC	Section 34-Uncontaminated Areas	05/87*

* - Draft Final



TASK 14 STUDY AREA

RI SUMMARY

Task Number: 15 Date: 11/02/87
Task Name: Army Sites South - Phase I Contamination Assessment
PMO Contact: Darryl Borrelli
Medium: Soil
Award Date: January, 1986
Budget: \$4,181,323
Prime Contractor: Ebasco Services, Inc.

Objectives

Task 15 investigated the extent of soils contamination in the southern portion of Rocky Mountain Arsenal at Army sites and in the portions of section which were outside designated contaminated site boundaries.

Scope-of-Work

Task 15 is a Phase I remedial investigation which consisted of a historical investigation and a soil survey of Sections 3, 4, 5, 6, 7, 8, 9, 11, 12, 31, 32, and 33. The historical investigation was used to determine the past uses of identified source areas and possible additional source areas not previously identified. For the soil survey, soil samples were taken in 11 identified source areas (4-2, 4-3, 4-4, 4-5, 5-2, 6-6, 31-4, 31-6, 31-7, 32-5, and 32-6), and in the portions of the sections listed above which were outside of these identified source areas. These samples analyzed for organic and inorganic (metal) analytes, including volatile and semivolatile organic compounds (GC/MS), DBCP (GC), ICP metals, mercury, arsenic (AA), organophosphorous pesticides (GCNPD), and army agent degradation products. Not all samples were analyzed by all methods. Samples analyzed from outside identified source areas were generally composites of the 0 to 1 and 4 to 5 ft intervals of a single boring.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Technos, Inc.	-	geophysics
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying
UXB	-	ordnance sites

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87007R40	06/86
Technical Plan, Final		ongoing

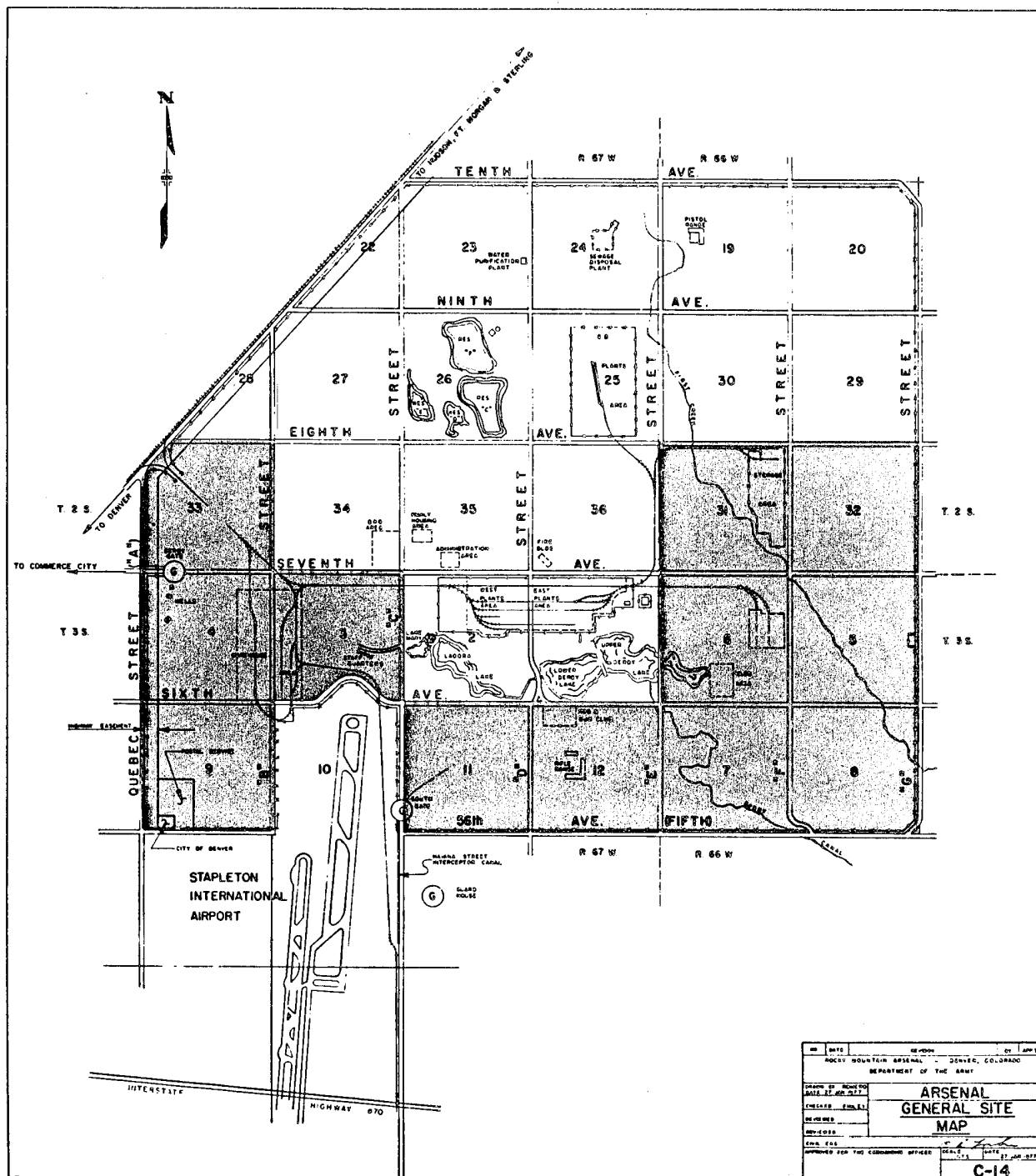
Contamination Assessment Reports:

<u>Site</u>	<u>Name</u>	<u>RIC#</u>	<u>Date Produced</u>
3-UNC	Uncontaminated Areas	87217R02	08/87*
4-UNC	Uncontaminated Areas	87217R03	08/87*
4-2	Burning Pit	87197R03	06/87*
4-3	Burning Pit		ongoing
4-4	Burning Pits		ongoing
4-5	Borrow Pit	87217R01	07/87*
5-UNC	Uncontaminated Areas		ongoing
5-2	Potential H/HD Contamination		ongoing
6-UNC	Uncontaminated Areas		ongoing
6-6	Former Toxic Gas Storage Yard		ongoing
7-UNC	Uncontaminated Areas	87097R03	04/87*
8-UNC	Uncontaminated Areas	87097R04	04/87*
9-UNC	Uncontaminated Areas	87097R05	04/87*
11-UNC	Uncontaminated Areas	87216R10	07/87
12-UNC	Uncontaminated Areas	87216R11	07/87
31-UNC	Uncontaminated Areas	87097R07	04/87*
31-4	New Toxic Gas Storage Yard		ongoing
31-6	Storage Sheds		ongoing
31-7	Storage Sheds		ongoing
32-UNC	Uncontaminated Areas		ongoing
32-5	Burning Pits		ongoing
32-6	Burning Pits		ongoing
33-UNC	Uncontaminated Areas		ongoing

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TASK 15 STUDY AREA

RI SUMMARY

Task Number: 18 Date: 12/03/87
Task Name: Air Quality
PMO Contact: Kevin Blose
Medium: Air
Award Date: Fall 1985
Budget: \$500,000 with modification
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Evaluation of air quality and meteorological parameters to define current conditions at RMA and to anticipate potential problems during future remedial actions.

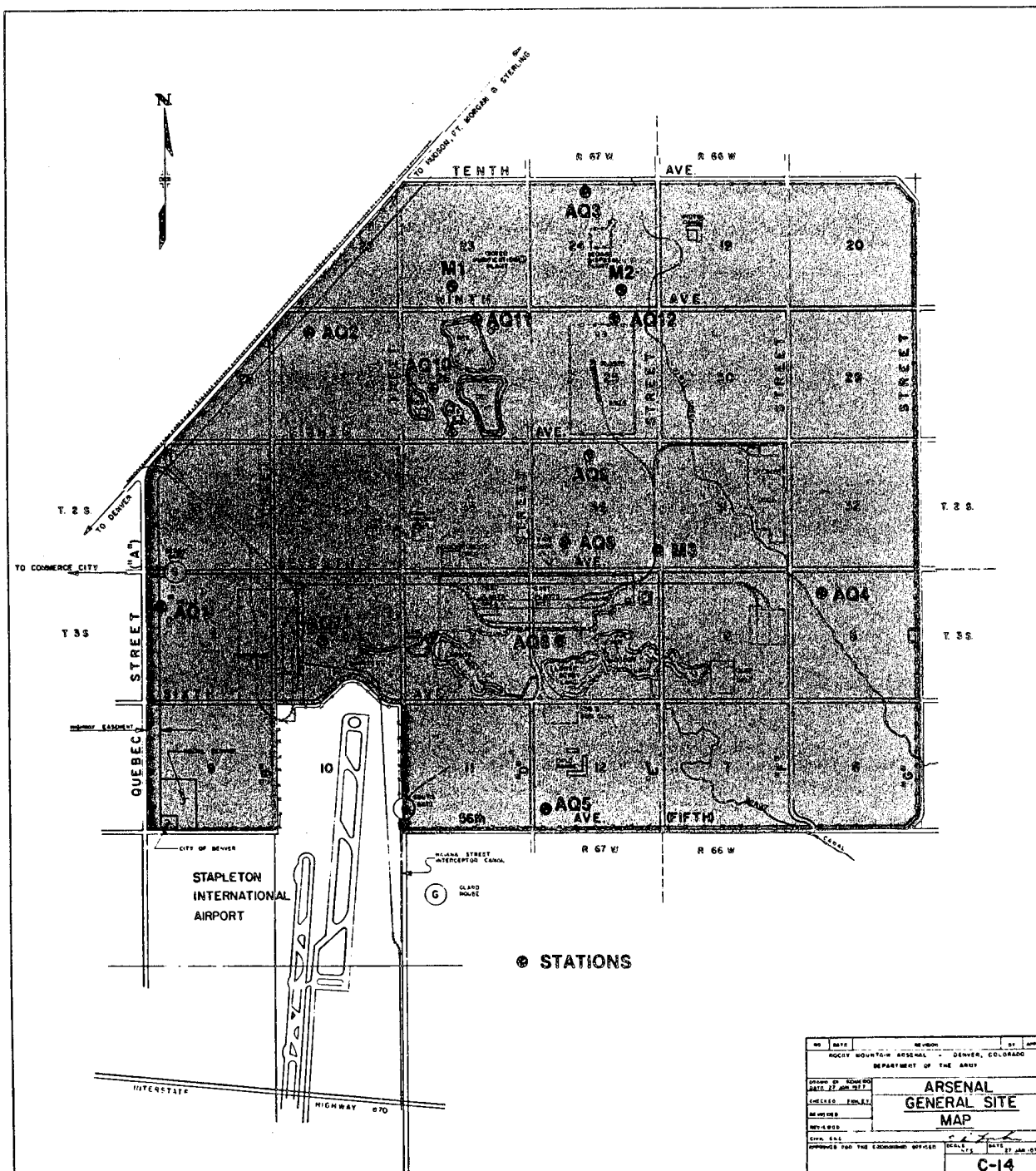
Scope-of-Work

Air quality parameters were monitored at 12 stations for TSP, PM-10, asbestos, VOC, SVOC, and metals. Meteorological parameters were monitored at three stations for wind speed and direction, atmospheric stability, temperature, pressure, and precipitation. These parameters were monitored for one year (see figure for station locations).

Consultants

None

Reports	RIC #	Date Produced
Technical Plan, Draft Final	86238R07	5/86
Technical Plan, Final		2/87
Contamination Assessment Report		ongoing



TASK 18 STUDY AREA

RI SUMMARY

Task Number: 19 Date: 12/03/87
Task Name: Phase II Survey Sections 26 and 35
PMO Contact: Darrel Smith
Medium: Soil
Award Date: September 30, 1986
Budget: \$1.2 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Task 19 is designed to complement the Task 6 (Phase I) soil investigation of Sections 26 and 35 (see figure). During Task 6, chemical analysis of sediment samples from soil borings at discrete contaminated sites (basins, associated ditches, deep injection well) and "uncontaminated" areas identified isolated points of potential contamination and provided enough data to roughly estimate the volume of potentially contaminated soil at each site. Task 19 will allow for more precise quantification and characterization of the contamination present at each site. Soil borings will be drilled and sampled at each site in areas where Phase I data were not collected or are incomplete. All samples will be analyzed by Phase II methods which yield lower detection limits.

Scope-of-Work

Task 19 is the Phase II continuation of Task 6. This investigation will include a survey of soil contamination at discrete sites and the installation of ten alluvial ground water monitoring wells in Sections 26 and 35. The sites to be addressed are: 26-1 (Deep Injection Well), 26-3 (Basin C), 26-4 (Basin D), 26-5 (Basin E), 26-6 (Basin F), 35-4 (Basins A-B-C Drainage Ditches), 35-3 (Basin B), and possible point sources in "uncontaminated" areas of Sections 26 and 35 (26-UNC and 35-UNC).

Soil samples will be collected at each site from continuous hollow-stem auger borings. Sample depths will vary from boring to boring according to site geology/hydrology and depths of contamination estimated from Phase I data. Several samples will be obtained at the water table at each site. In addition, 25 surficial soil samples will be taken using hand tools outside of Site 26-6 along prevailing wind vectors. The Task 19 soil sampling program will obtain a total of 669 samples (including the 25 surficial soil samples) from 200 boring locations.

The soil samples will be analyzed by specific Phase II methods for: organochlorine pesticides (GC), organosulfur compounds (GCFP), organophosphorus compounds (GCFPD), ICP metals, arsenic, mercury, purgeable aromatics (GC), DBCP (GC), DCPD, and Army agent degradation products. In addition, selected samples will also be analyzed by Phase I methods for semivolatile and volatile organic compounds.

Water samples will be obtained from the 10 alluvial wells to be drilled. Well sites will be located to complement other ongoing ground water investigations. These samples will be analyzed for the standard Phase I compounds including: pesticides, metals, semivolatile and volatile organics, and sulfur compounds.

Consultants

HLA - field Work
Boyles Brothers - drilling
ITECH - surveying

Reports Produced

RIC #

Date

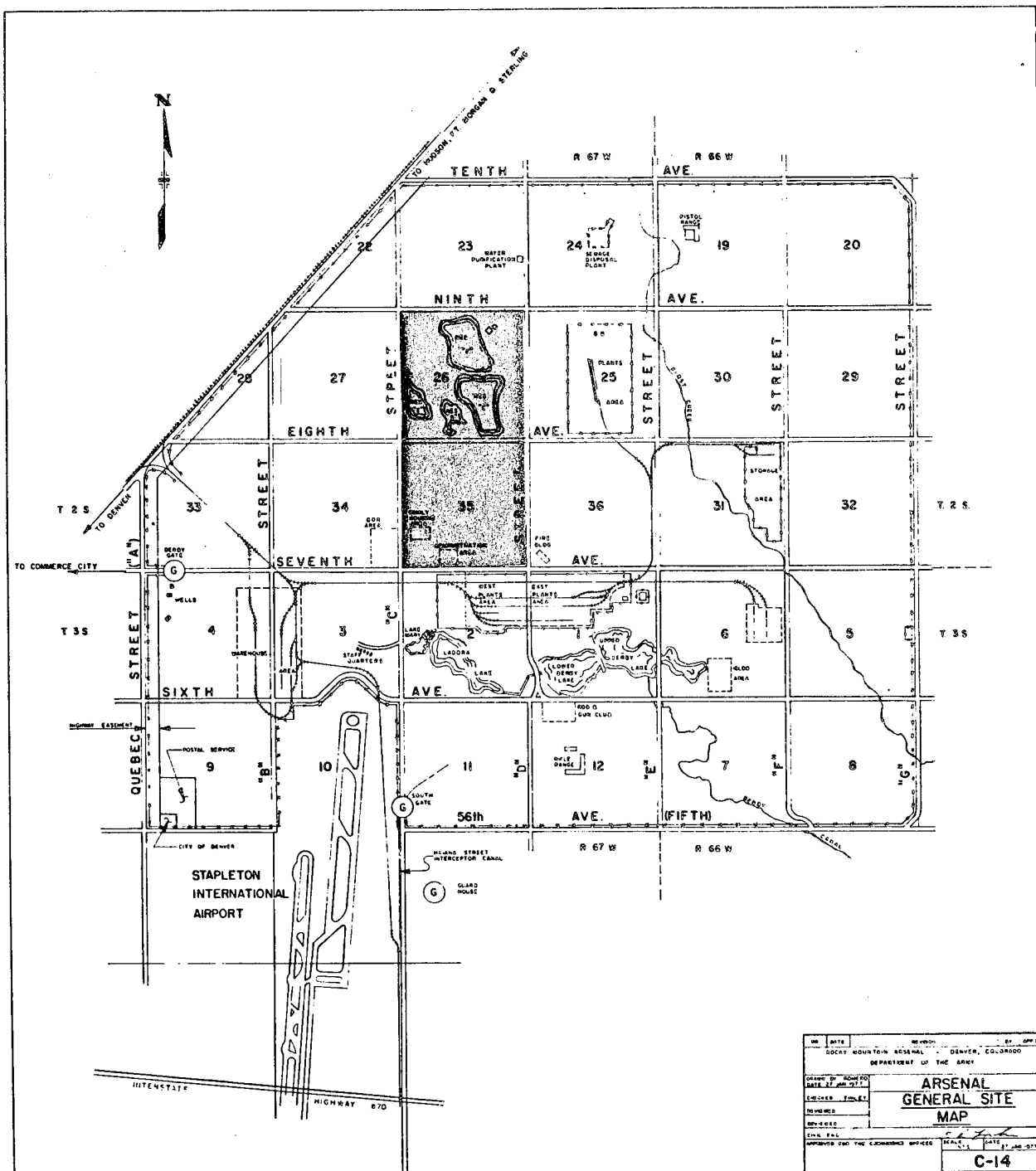
Task 6 Contamination Assessment Reports - Phase I:

Site	Name		
26-1	Deep Injection Well		ongoing*
26-3	Basin C		ongoing*
26-4	Basin D	87293R01	10/87
26-5	Basin E	87203R04	7/87
26-6	Basin F		ongoing*
35-3	Basin B	87203R05	7/87
35-4	Basins A-B-C Drainage	87203R06	7/87
26-UNC	Section 26-Uncontaminated Areas		10/87
35-UNC	Section 35-Uncontaminated Areas		ongoing*

Contamination Assessment Reports, Phase II Addenda

ongoing

* - Draft Final



TASK 19 STUDY AREA

RI SUMMARY

Task Number: 20 Date: 11/02/87
Task Name: Lakes Area - Phase II Contamination Assessment
PMO Contact: Juan Lopez
Medium: Soils, sediments, water
Award Date: September, 1986
Budget: \$1,139,426
Prime Contractor: Ebasco Services, Inc.

Objectives

The Task 20 Phase II investigation will verify and correlate Tasks 7 and 12 Phase I soil sampling results in the Lower Lakes Region and other miscellaneous areas of RMA, such as landfills, ditches, and sewage treatment plants in Sections 1, 2, 3, 24, and 30. The Phase II investigation will revisit most of the contaminated and uncontaminated areas identified and investigated under Tasks 7 and 12. Phase II investigations will further define soil contamination in sites or areas investigated under Tasks 7 and 12. This information will be used to estimate the volume of contaminated soil in these areas.

Scope-of-Work

Task 20 is the Phase II investigation in the Lower Lakes Region and miscellaneous areas of RMA, and is a follow-on program to the Phase I investigations for Tasks 7 and 12. As of this date, 12 sites have been identified as contaminant sources and were sampled in Task 20. These sites are: 1-1, 1-9, 2-1, 2-17, 24-6, 30-4, 1-UNC, 1-2, 1-12, 6-2, 11-1, and 12-2. Sites 3-4, 3-2/3-3, 12-1, 24-7, and 1-6 are ongoing programs and have not yet been investigated under Task 20.

A total of 224 borings will or have been drilled. In addition, 3 trenches were excavated at Site 1-12, yielding 3 additional samples. A soil gas survey to investigate the source of a benzene plume (Sites 1-9 and 1-11) will be performed.

The soil samples are being analyzed for compounds such as volatile and semivolatile organics (GC/MS), hydrazine (SPECT), ICP metals, arsenic and mercury (AA), volatile halogenated organics (GCCON), organochlorine pesticides (GCEC), Army Agent degradation products, dibromochloropropane (GC), and hydrocarbons (GC/FID). Additional analyses will be conducted in the lakes region sediments for the following: total organic carbon, particle size analyses, percent moisture, pH, electrical conductance, and redox potential.

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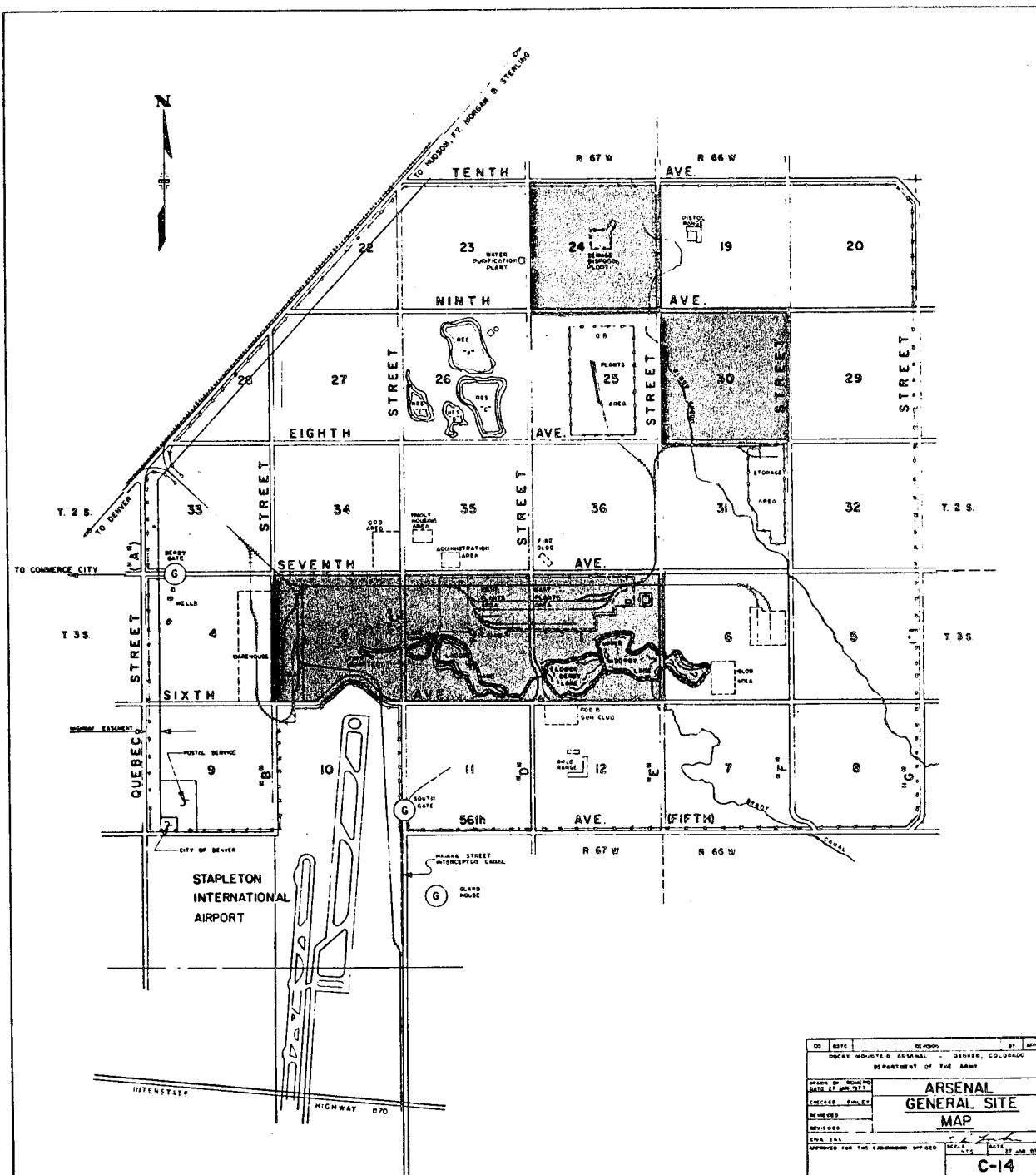
Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Earth Technology Corporation	-	physical lab analyses
PETREX, Inc.	-	soil gas lab analyses
Professional Service		
Industries, Inc. (PSI)	-	lakes drilling
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final		09/87
Technical Plan, Final		ongoing
Phase II Addendums		ongoing

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TASK 20 STUDY AREA

RI SUMMARY

Task Number: 21 **Date:** 12/03/87
Task Name: Phase II Survey of Army Sites North
PMO Contact: Darryl Borrelli
Medium: Soil
Award Date: September 30, 1986
Budget: \$1.59 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Task 21 is designed to complement the Task 14 (Phase I) soil investigation of the northern sections of RMA (see figure). This task provides technical support in the form of a final (white cover) document for each site investigated under Task 14. Task 21 will further define the extent of contaminated areas as well as provide volume estimates of potentially contaminated soil. Soil borings will be drilled and sampled at each site in areas where Phase I data were not collected or are incomplete. All samples will be analyzed by Phase II methods which yield lower detection limits.

Scope-of-Work

Task 21 will incorporate Task 14 results and includes a survey of soil contamination at 12 sites: 29-4, 30-1, 30-3, 30-5, 30-6, 35-2/26-9, 35-7, 36-2, 36-6, 36-9, 36-18, and 36-19. The "uncontaminated" areas of Sections 20, 23, 25, 29, and 30 (20-UNC, 23-UNC, 25-UNC, 29-UNC, and 30-UNC) will also be investigated further. Approximately 292 samples from 140 borings are proposed for chemical analyses, consisting of arsenic, mercury, ICP metals, organochlorine pesticides, DIMP, DCPD, thiodiglycol (mustard degradation product), IMPA (GB degradation product), and volatile and semivolatile organics depending on the site. Additional physical investigations are proposed for trenching programs for possible unexploded ordnance, as well as installation of six monitor wells in the vicinity of Section 25. The boring and chemical analysis procedures follow the approved QA/QC, safety, data management, contamination assessment, and management plans. Final CARs will be prepared for each Task 14 site.

Consultants

HLA - field work
MRI - chemical Analysis
Fox - drilling
Boyles Brothers - drilling
ITECH - surveying

Reports **RIC #** **Date Produced**

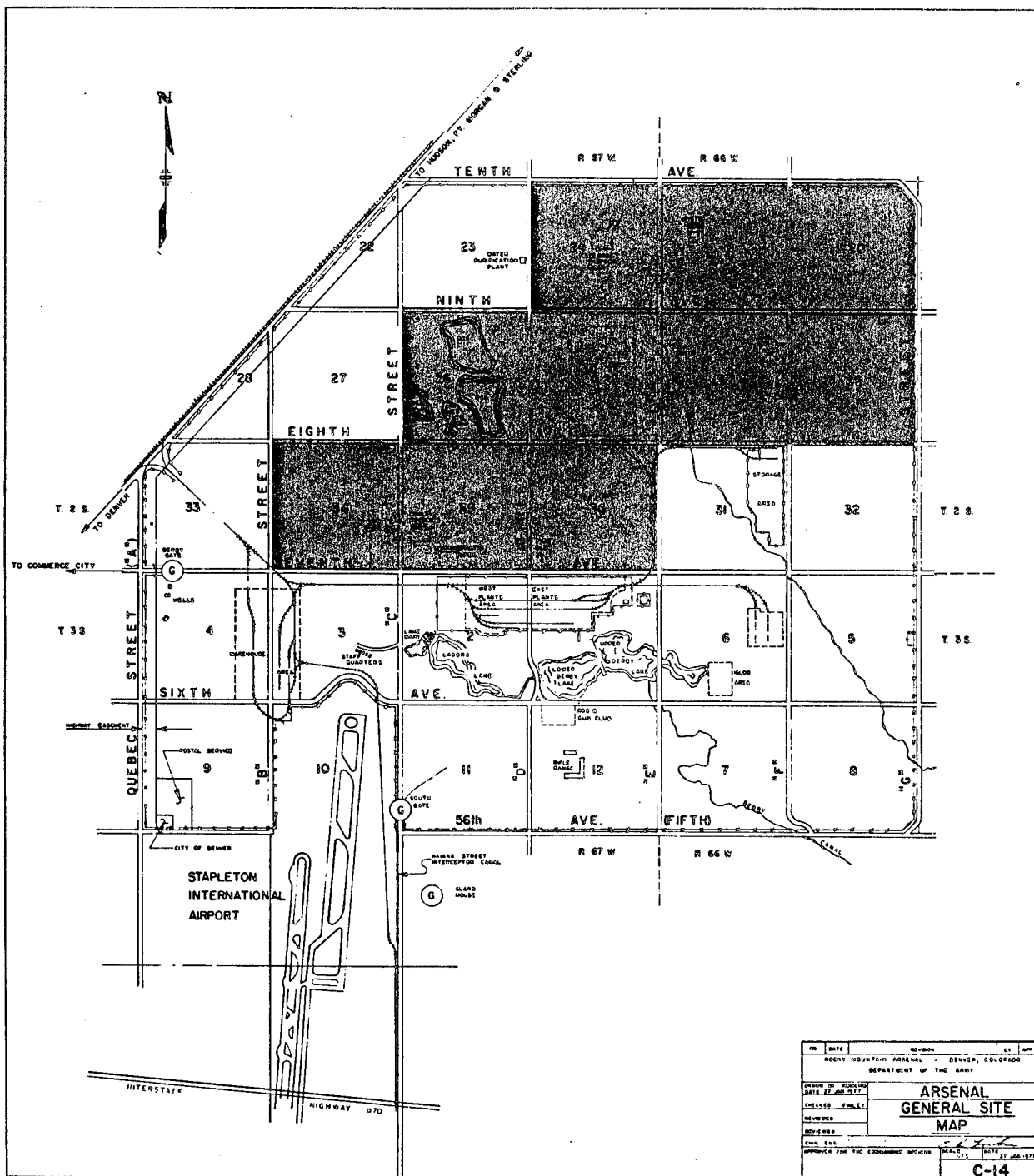
Task 14 Contamination Assessment Reports - Phase I:

Site	Name	RIC #	Date Produced
19-1	Burn Site, Incendiaries	87204R02	ongoing*
20-1	Burn Site, Incendiaries	87204R03	ongoing*
26-9/35-2	Chemical Sewer		ongoing*
29-1	Burn Site, Incendiaries	87204R06	ongoing*
29-4	Disposal Site for Explosive and Incendiaries		ongoing*
29-5/32-1	Bomb Site for Explosive and Incendiaries	87204R07	ongoing*
30-1/30-7	Impact Area/Ground Disturbance	87204R08	ongoing*
30-2	Burn Site, Incendiaries	87204R09	ongoing*
30-3	"H" Training Area		ongoing*
30-5	M-34 Demilitarization Operation Area	87254R01	ongoing*
30-6	Liquid Disposal Trenches	87204R10	ongoing*
35-6	Possible Munitions Test Area	87204R11	ongoing*
35-7	Firing Range		ongoing*
36-2	Munitions Test Area and Site Incendiary Drop		ongoing*
36-6	Possible Test Site with Trench		ongoing*
36-9	Incendiary or Munitions Test Area		ongoing*
36-13	Trenches	87204R14	ongoing*
36-14	Mustard Plant Disposal Site	87254R02	ongoing*
36-16	Incendiary Burial Site		ongoing*
36-18	Possible Trench Disposal Sites		ongoing*
36-19	Ground Scars, History unknown	87224R01	ongoing*
19-UNC	Section 19, Uncontaminated Areas	87204R01	ongoing*
20-UNC	Section 20, Uncontaminated Areas		ongoing*
22-UNC	Section 22, Uncontaminated Areas	87204R04	ongoing*
23-UNC	Section 23, Uncontaminated Areas		ongoing*
24-UNC	Section 24, Uncontaminated Areas	87224R02	ongoing*
25-UNC	Section 25, Uncontaminated Areas		ongoing*
27-UNC	Section 27, Uncontaminated Areas	87204R12	ongoing*
28-UNC	Section 28, Uncontaminated Areas	87204R05	ongoing*
29-UNC	Section 29, Uncontaminated Areas		ongoing*
30-UNC	Section 30, Uncontaminated Areas		ongoing*
34-UNC	Section 34, Uncontaminated Areas	87204R13	ongoing*

Contamination Assessment Reports, Phase II Addenda

ongoing

* - Draft Final



TASK 21 STUDY AREA

RI SUMMARY

Task Number: 22 Date: 11/02/87
Task Name: Army Sites South - Phase II Contamination Assessment
PMO Contact: Darryl Borrelli
Medium: Soils
Award Date: September, 1986
Budget: \$1,731,369
Prime Contractor: Ebasco Services, Inc.

Objectives

Task 22 is continuing the investigation of source areas and sections initially investigated under Task 15, as deemed necessary after review of the Task 15 Phase I results. This continued investigation will be used in the Regional Study Area Reports to further define the extent of contamination and estimate the volume of potentially contaminated soil.

Scope-of-Work

Task 22 is a Phase II remedial investigation. It is a further investigation of those areas investigated under Task 15 (identified source areas and remaining portions of Sections 3, 4, 5, 6, 7, 8, 9, 11, 12, 31, 32, and 33) as required based on the results of the Phase I investigation.

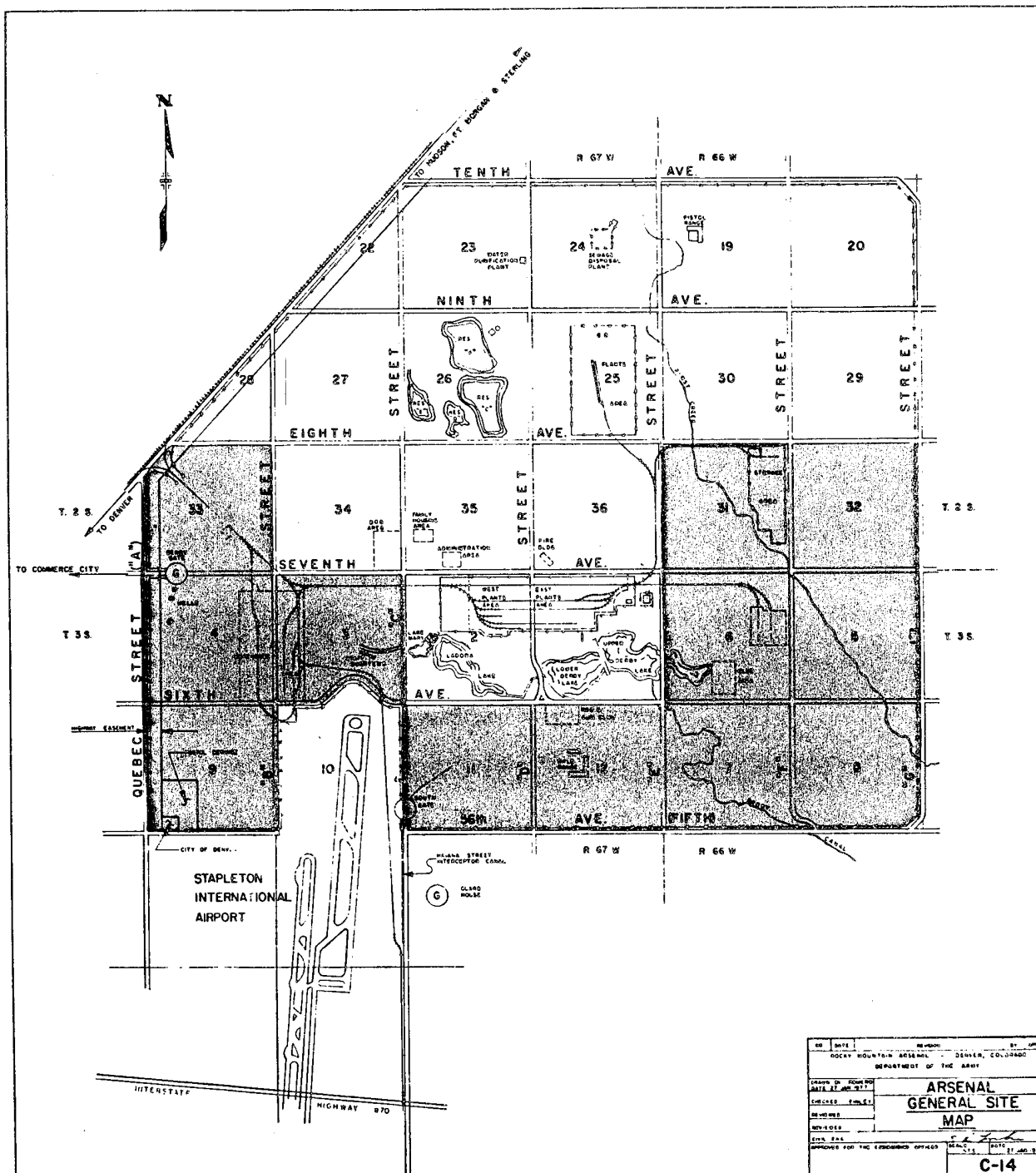
The Task 22 field program includes soil borings, geophysical reconnaissance, and trenching. Soil samples are being analyzed for volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA), organochlorine pesticides (GCEC), organophosphorous pesticides (GCNPD), army agent degradation products, volatile aromatic compounds (GCPID), and volatile halogenated compounds. Not all samples will be analyzed by all methods.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Phase II Addendums		ongoing



TASK 22 STUDY AREA

RI SUMMARY

Task Number: 23 Date: 12/03/87
Task Name: Overall Soils/Ground Water Integration
PMO Contact: Kevin Blose
Medium: Soils, Water
Award Date: September 23, 1986
Budget: \$626,007 with modifications
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Task 23 will develop the methodology to integrate soil/ground water/surface water results and coordinate this integration among the various study area reports. Semiquantitative methodologies to describe contaminant flux from soil sources to ground water, as well as contaminant transport and attenuation mechanisms in ground water will be investigated. The requirements of the EA and FS will be coordinated with preparation of RI work products. Guidance from EPA and the state will be incorporated.

Scope-of-Work

Task 23 will compile and evaluate soil and water data on an arsenal wide and study area basis in conjunction with other RI tasks. Critical sites will be identified and segregated for further detailed investigation. Coordination with the EA and FS groups will allow evaluation of the adequacy of existing data and the respective impacts of any data deficiencies. Recommendations regarding the technical feasibility of collecting data desired by these groups will be provided. Special work products, such as the CAR Introduction and the revised site map will be generated in support of the study area investigations.

The purpose of the task is to provide a means to relate soil and ground water contaminant concentrations and to devise an empirical approach for describing contaminant migration. Best professional judgement and reasonable assumptions will be used to generate a conceptual understanding of contaminant transport. A complex, numerical contamination transport model is not envisioned. Methods of evaluating and describing contaminant occurrence and transport in the unsaturated and saturated zones will be developed. These methodologies will rely on a generally simplified approach, and will attempt to provide a relatively uniform mechanism for integrating soil and water contaminant assessment results into a comprehensive RI. Requirements of the EA and FS groups will be an essential factor in determining the nature of the soil-water integration. Task 23 will provide support to the groups assembling RMA study area reports by assisting in the assembly, presentation, and interpretation of soil and water data. This interpretive process must be directed towards addressing the needs of eventual site remediation and documentation of the processes leading to the ROD.

Previous investigations at RMA and other contaminated sites have demonstrated the difficulty in simulating contaminant migration in a quantitative manner. Efforts to quantify contaminant flux at RMA would be costly and time consuming, and would be likely to yield little useful information. The quantification process would be useful in establishing the uncertainty of parameters such as partition coefficients, but the range of uncertainty is likely to be so large as to preclude accurate conclusions. In addition, one generalized approach would not be appropriate for all sites, nor would all sites require similar expenditure of effort. Those sites exhibiting unsaturated zone contamination down to the water table would require most intensive investigation, while those sites with low level or undetectable surface contamination would require minimal integration effort. Sites will require categorization and prioritization for Task 23 investigation based on existing contamination assessment results and the requirements of the FS.

The inadequacy of a quantitative evaluation of contaminant flux has led to semi-quantitative descriptions of contaminant migration potential. For instance, contaminants could be ranked in terms of high, medium, and low Henry's Law coefficients or affinities for soil organic carbon. Similarly, sites could be ranked by factors such as unsaturated zone contaminant proximity to the water table and relative permeability of soils. Semi-quantitative ranking schemes such as these could then be combined and used to evaluate the potential for contaminant leaching at sites of interest. The relative mobility of contaminants in the unsaturated zone would also be described in a semi-quantitative manner. Relative affinity of dissolved contaminants for the solid aquifer matrix is an important consideration in the evaluation of no-action alternatives and remedial system design life.

Consultants

HLA - development of methodology, report preparation
EBASCO - development of methodology, report preparation
Stollar & Associates - development of methodology, report preparation
Geraghty & Miller - development of methodology, report preparation

Reports	RIC #	Date Produced
Technical Plan, Draft Final		ongoing
Technical Plan for Determination of Partition Coefficients	87013R10	10/86
Determination of Partition Coefficients for the Primary Contaminant Sources of Section 36, Interpretive Report		ongoing

RI SUMMARY

Task Number: 24 Date: 11/02/87
Task Name: Structures Survey and Army Spill Sites,
Phase I Contamination Assessment
PMO Contact: Darryl Borrelli
Medium: Buildings, structures, soils, liquids
Award Date: September, 1986
Budget: \$947,044
Prime Contractor: Ebasco Services, Inc.

Objectives

The objectives of the Structure Survey portion of Task 24 is to develop physical inventories of all structures on RMA, estimate the volume of materials contained in the structures, and assess the nature of contamination in RMA structures based primarily on historical research. The objective of the Army spill sites portion of Task 24 is to conduct Phase I investigations of reported Army spill sites at RMA additional to those investigated under other tasks. No Phase II investigations are planned.

Scope-of-Work

Task 24 (Structures) has verified the location and physical description of all structures on RMA through literature searches, examination of aerial photography, and field reconnaissance. It has prepared updated Basic Information Maps and built a database containing basic physical information, use, status and contamination classification for each structure. Ongoing work includes preparing uniform profiles of each building and tank emphasizing history of ownership, use, and associated chemicals. The task has also assigned contamination classifications for buildings and tanks based on the history of use, provided quantitative volume estimates of materials comprising the structures, and provided an estimate of the volume of asbestos present in RMA structures. Limited sampling of standing liquid in structures and of materials suspected of containing asbestos was conducted.

Task 24 (Spills) includes the compilation of historical information regarding potential soil contamination associated with 41 possible Army spill sites, 39 in the South Plants area of Sections 1 and 2 and 2 in the North Plants area of Section 25. Soil borings and soil gas investigations have been conducted where historical information indicates a likelihood of soil contamination.

Twenty-nine of these sites were identified in a letter dated May 1985 by Shell Chemical Company to the Army; additional sites were identified through research conducted by Ebasco.

The following table lists the 21 sites actually sampled and the studies conducted under Task 24 (Spills). Site numbers are those originally listed in the Shell letter (Sites 1-29); for additional sites identified by Ebasco, the Shell numbering system has been continued in sequence (Sites 30-41).

Army Spill Site No.	Location	Study
2	Section 1; Building 513 and unlined basins north of Building 512.	Phase I soils
5	Section 1; Lewisite production area (includes Buildings 511, 512, 514, 515, and 516 and surrounding areas).	Phase I soils
6	Section 1; an area west Buildings 536 and 537.	Phase I soils
7	Section 1; northeast of Building 536 and south of Building 537.	Phase I soils
8	Section 1; area between Buildings 514 and 529.	Phase I soils
9	Section 1; area south of Building 732.	Phase I soils; soil gas
10	Section 1; Building 753.	Phase I soils
12	Section 1; holding pits outside of Building 522; M-1 settling ponds (Army Spill Site No. 2); Building 514 (SO ₂ disposal plant).	Phase I soils
13	Section 1; arsenic trioxide storage silos 523C, 523D, 523E, 523F, 523G, and associated conveyance and loading areas.	Phase I soils
14	Section 1; mustard decontamination pits, Buildings 417 and 427.	Phase I soils
15	Section 1; decontamination pit near the southeast corner of Building 514.	Phase I soils

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Army Spill Site No.	Location	Study
16	Section 1; laundry and clothing treatment facility (Building 314), unlined surface ditch east of Building 314.	Phase I soils
17	Section 1; Building 313 and open ditch east of Building 313.	Phase I soils
18	Section 1; areas in and around the maintenance shops (Buildings 533 and 534).	Phase I soils; soil gas
19	Section 1; areas in and around the heavy industrial equipment renovation facilities in Building 751.	Phase I soils
20	Section 1; flow from caustic tank east of Building 536 into drainage ditch west of the tank.	Phase I soils
25	Section 1; drainage ditch north of Building 541.	Phase I soils
29	Section 1; former settling basin now beneath Building 523.	Phase I soils
37	Section 1; ditch beginning of SE corner of Building 742.	Phase I soils
40	Section 1; between Buildings 512 and 514.	Phase I soils (includes 3 trenches)
41	Section 2; chlorine plant (locations to be determined).	Phase I soils

Analytical parameters for Phase I soil samples are volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA), and thiodiglycol.

Consultants

R.L Stollar and Associates	-	field work, reports, structure histories
Custom Auger	-	drilling
Phoenix Safety	-	field health & safety
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
ESE	-	chemical analyses
QC Data	-	GIS/AutoCAD RMA map updating
ITECH	-	surveying
MTA Remedial Resources, Inc.	-	field work
EHRT	-	earth moving
Target Environmental Services	-	soil gas

Reports

	<u>RIC#</u>	<u>Date Produced</u>
<u>Spills</u>		
Technical Plan, Draft Final	87007R18	01/87
Technical Plan, Final		ongoing
<u>Structures</u>		
Technical Plan, Draft Final		02/87
Technical Plan, Final		ongoing
CAR, Volume I		ongoing
CAR, Volume II		ongoing
CAR, Volume III		ongoing

RI SUMMARY

Task Number: 25 Date: 12/03/87
Task Name: RMA Boundary Systems Monitoring
PMO Contact: Brian Anderson
Medium: Water
Award Date: July 1986
Budget: \$4.5 million with modifications
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

The objectives of Task 25 are to monitor ground water flow and contaminant transport in and around the North and Northwest Boundary Containment Systems, to define contaminant pathways in these areas, and to provide chemical and hydrologic data for the operation of the North and Northwest Boundary Containment Systems (see figure). The Irondale Containment System will be monitored by Shell Chemical Company. The means by which the objectives of Task 25 will be achieved are set forth in Section 1.4 of the Task 25 Technical Plan (RIC#87014R24).

Scope-of-Work

The scope-of-work for Task 25 includes:

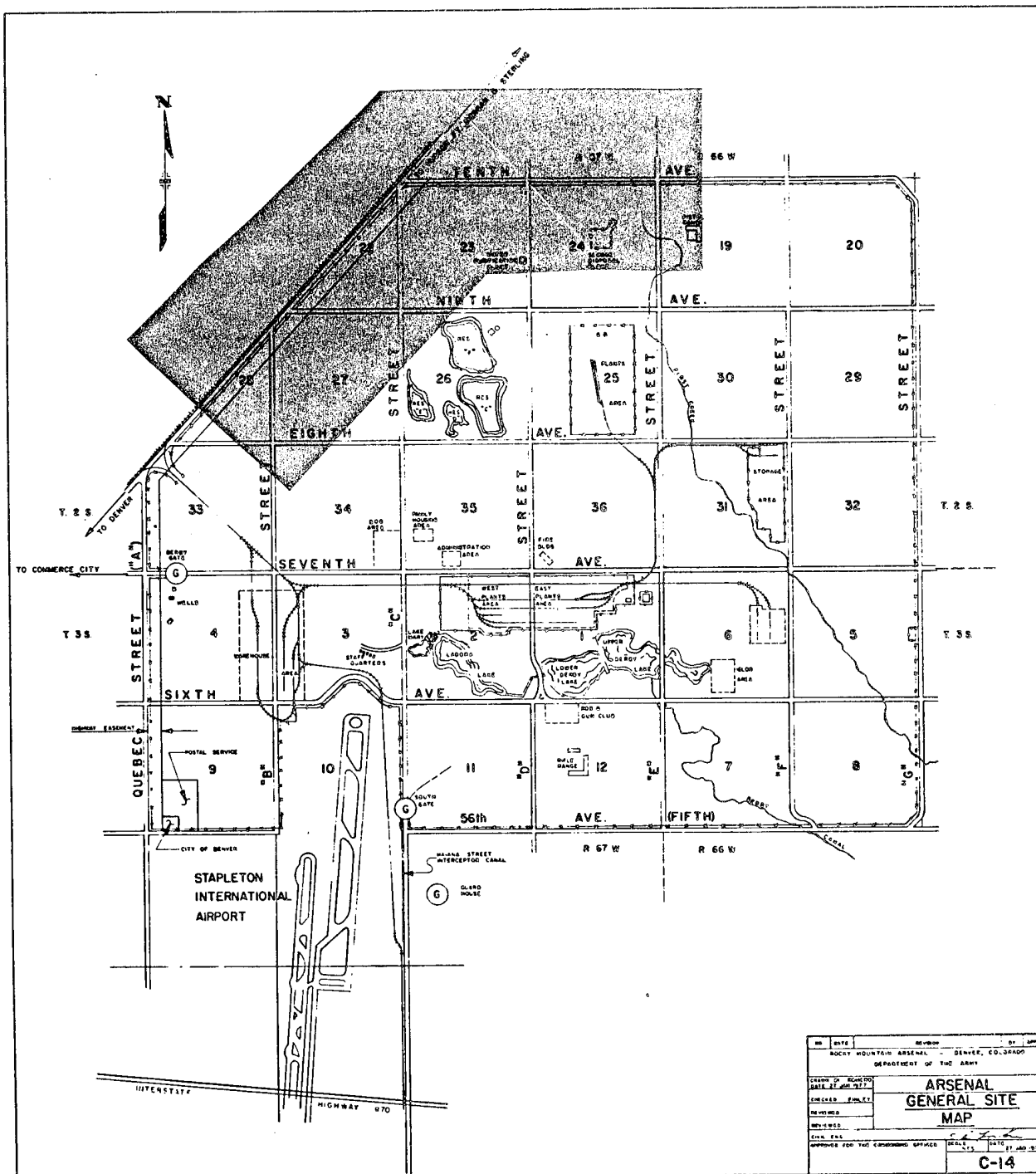
- o A detailed geologic study of the Denver Formation and the alluvial aquifer. This study will entail the construction of isopach maps, cross sections, structure contour maps, and other types of diagrams. It will attempt to define the geometry and extent of various rock and soil units that may be important to the hydrogeologic framework of the boundary area and the migration of contaminants;
- o Long-term monitoring of wells on a quarterly basis to determine the distribution and concentration of contaminants and the configuration of piezometric surfaces associated with specific aquifers. For the first quarter of sampling which was completed during September 1986, a network of 155 wells was employed to collect chemical data. Water levels were taken from all wells sampled and from an additional 214 wells where no water samples were collected. After an interpretation of the first quarter sampling results, the initial monitor well network may be adjusted to ensure a more complete coverage of the contaminant plumes. This adjustment phase may include the installation of additional monitor wells. Changes in the monitoring network, including any new well installations, will be documented in letter technical plans which will act as amendments to the Technical Plan; and
- o Maps showing contaminants distribution and the configurations of piezometric heads along with pertinent geologic and hydrologic data will be prepared to support the operations of the North and Northwest Boundary Containment Systems enabling them to increase operating efficiencies.

Consultants

HLA - field work
ITECH - surveying
Boyles Brothers - drilling

Reports

	<u>RIC #</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87014R24	02/87
Final Report		ongoing



TASK 25 STUDY AREA

RI SUMMARY

Task Number:	32	Date:	11/02/87
Task Name:	Waste Handling		
PMO Contact:	Ed Berry		
Medium:	Water, soil, contaminated trash, etc.		
Award Date:	September, 1986		
Budget:	\$683,634		
Prime Contractor:	Ebasco Services, Inc.		

Objectives

The objective of Task 32 is to provide technical support to both Ebasco and Environmental Science and Engineering, Inc. to transport from a central location and handle any liquid and solid waste generated as part of the Remedial Investigation Feasibility Study (RI/FS) field efforts at the Rocky Mountain Arsenal (RMA). Rinse wastewater, monitoring well development and purge water, soil cuttings, soil cores, contaminated clothing and other trash will be drummed or boxed, sampled, analyzed, disposed and/or stored according to all applicable State and Federal regulations. In addition, providing, maintaining, and making storage space for the liquid and solid waste will be included in this task. Disposal of all noncontaminated waste generated as part of the RI/FS efforts also will be performed.

Scope-of-Work

Task 32 encompasses all work associated with handling liquid or solid waste generated as part of the RI/FS field efforts. It will provide support to other RI/FS tasks for the collection, identification, storage, and possible disposal of potentially contaminated wastes generated during field activities.

All waste will be stored in drums or bulk holding tanks, sampled and analyzed, and then stored or disposed according to established procedures. The drums will be stored in designated/approved buildings until on-post or off-post disposal sites can be identified. When approval is given, purge water with known contaminant concentrations will be disposed into the appropriate boundary containment system or into the South Plants Laboratory Waste Treatment Facility (SPLWTF) according to influent limitations. All uncontaminated soils and soils which will have contaminant concentration under the final remediation action levels will be disposed into the north section of the RMA sanitary landfill. All other contaminated wastes will be stored until final disposal can be determined. All waste containers will be labeled with generator, task number, drum/tank number, date, contents, section, sites, and well/boring number. Analysis will be performed on all liquid/solid wastes for which no data exists, before storage occurs.

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Ebasco will maintain several databases including an existing drum waste inventory, disposed drum waste inventory, disposed purge water inventory, and the chemical analyses of material from bulk holding tanks.

The soil and water samples are being analyzed for the Phase I compounds including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, mercury, and arsenic (AA), and thiodiglycol (HPLC).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	labor
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final		March, 1987
Technical Plan, Final		ongoing

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RI SUMMARY

Task Number:	35	Date:	11/03/87
Task Name:	Endangerment Assessment		
PMO Contact:	Andrew Kingery		
Medium:	N/A		
Award Date:	June, 1986		
Budget:	\$955,557		
Prime Contractor:	Ebasco Services, Inc.		

Objectives

The objective of Task 35 is to develop an Endangerment Assessment (EA) for Rocky Mountain Arsenal (RMA) that quantifies the magnitude and probability of actual and potential harm to public health, welfare or the environment by the threatened or actual release of hazardous substances from the Arsenal for the no-action alternative and for the remedial cleanup levels evaluated. This assessment will be performed consistent with CERCLA as amended, the NCP, and the EPA guidelines for performing an endangerment assessment (The Endangerment Assessment Handbook USEPA 1985a).

The Endangerment Assessment will investigate to what extent existing soil contamination poses a potential threat to human health and the environment.

Scope-of-Work

Task 35 will compile and integrate existing, ongoing, or planned studies within the RMA RI program of direct relevance to the EA task, identify contaminants, prepare an exposure assessment for contaminated sites at RMA, prepare a toxicity assessment for each target contaminant, prepare a risk analysis and quantification of risks associated with the presence of contaminants at RMA, and document the EA in a synthesis report addressing exposure, toxicity, and risk characterization.

Ebasco Services Inc.

PRIME CONTRACTOR

None

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87097R02	01/87
Technical Plan, Final		ongoing
PPLV Methodology as Applied to RMA	87197R04	06/87*
Toxicity Assessment for RMA Target		
Contaminants	87197R04	06/87*
Land Use Scenario Summary		ongoing
Exposed Population Description		ongoing
PPLVs		ongoing
Source-by-Source Exposure Assessment		ongoing
Documentation of the Uncertainty Analysis		
Procedures		ongoing
Executable Computer Models and Manuals		ongoing
Probability of Exceedance Curves		ongoing
EA Synthesis Report		ongoing

* - draft final

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RI SUMMARY

Task Number: 36 Date: 12/03/87
Task Name: North Boundary System Component Response Assessment
PMO Contact: Brian Anderson
Medium: Ground Water
Award Date: October 1, 1986
Budget: \$722,634 with modifications
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Evaluate the adequacy of the dewatering and recharge components of the North Boundary System (see figure) through a review of the operational data, performance testing of the components, and evaluation of additional geotechnical data. Assess the configuration of the Denver Formation sandstones and evaluate their hydrologic characteristics, especially in the area of the Pilot System, through the acquisition and evaluation of additional geologic and hydrologic data. Assess the physical condition of the soil-bentonite barrier through in-situ and laboratory testing, especially in areas suspected of having problems. The testing will consider physical and chemical degradation of the wall. Assess the adequacy of the carbon-adsorption type treatment system to effectively remove contaminants to appropriate cleanup goals through the analysis of effluent water samples.

Scope-of-Work

Task 36 will further characterize the geologic regime in the vicinity of the NBCS using data from previous investigations and additional data to be collected as part of this task. Where historical data is lacking, additional soil borings will be constructed and soil and rock samples collected. Particular attention will be directed to the areal extent and position of Denver sand units.

In addition to the geologic characterization, a hydrologic evaluation will be performed using primarily water level and quality data. Much of this data is being collected as part of the regional Water Quality/Water Quantity Survey (Tasks 4 and 44) and the Boundary System Monitoring (Task 25) task. To complement the information available from these tasks and fill data deficiencies, the scope-of-work includes installation, development, and sampling of new ground water monitoring wells in selected locations. As these new wells are completed and developed, they will be sampled for water quality parameters to aid in the identification of other locations for which monitoring wells may provide valuable information and will be sampled in coordination with Tasks 25 and 44 sampling events to provide integrated data sets.

Using the data described above, an assessment of the hydrologic conditions in the vicinity of the NBCS will be performed. This will include an assessment of both dewatering and recharge components of the NBCS and the hydrologic relationship between saturated portions of the alluvium and the Denver Formation.

The carbon-adsorption type water treatment plant will be evaluated to ensure that contaminants intercepted can be treated to appropriate cleanup goals. This evaluation will include the analysis of effluent water samples for water quality. In addition, turbidity tests on the effluent water will be conducted to evaluate what effect carbon fines may have on plugging of the recharge wells.

To complete the assessment of the NBCS, the Task 36 scope-of-work will include an evaluation of the physical condition, integrity, and hydrologic properties of the soil-bentonite barrier. Samples of the barrier will be collected and subjected to both physical and hydrologic testing. This data in conjunction with results of the geologic and hydrologic assessment should allow evaluations of the effectiveness of the barrier.

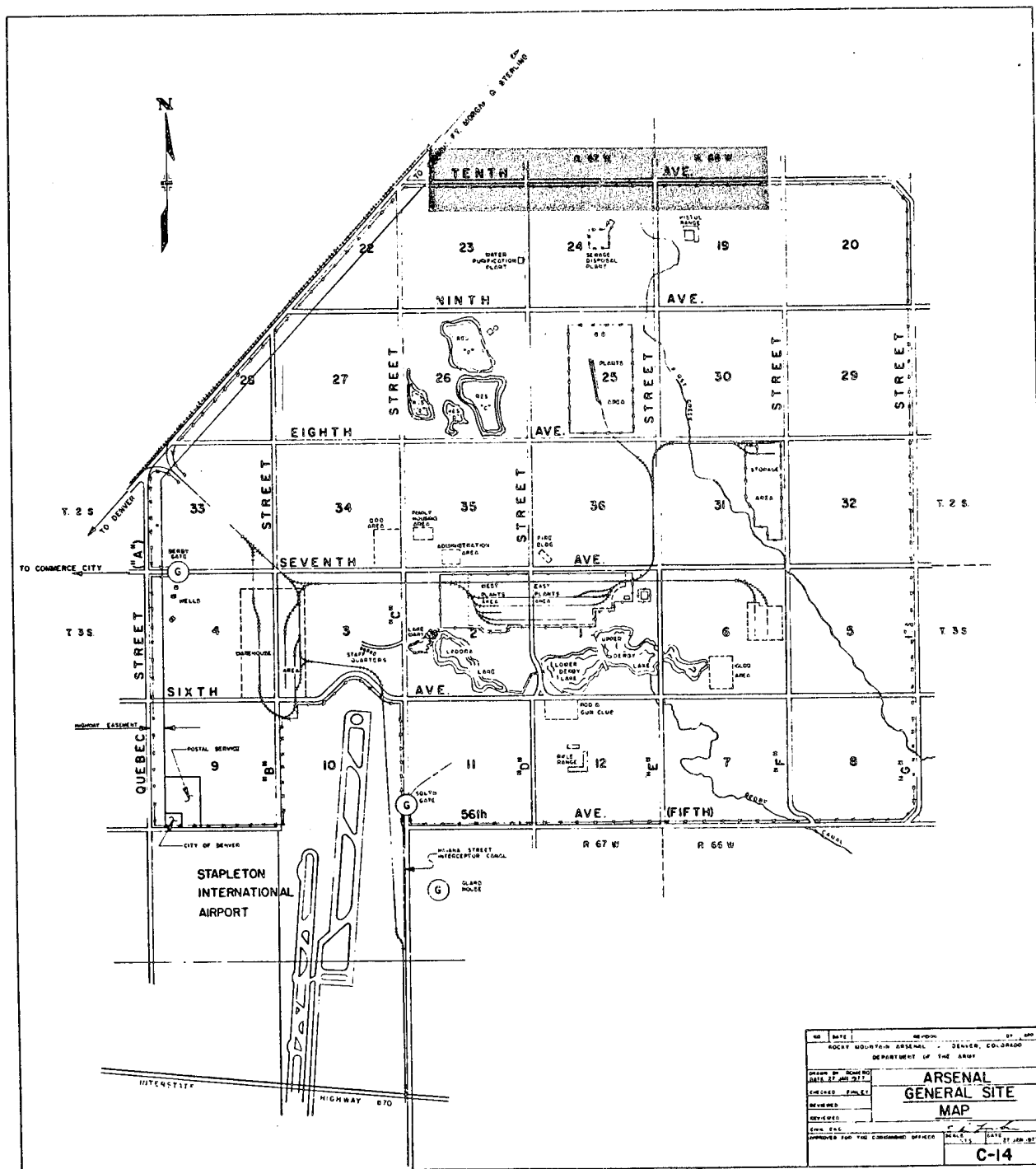
Upon completion of data assessment, conceptual response actions which may enhance system performance will be developed and evaluated. These actions may include physical modification to the NBCS and/or modifications to the NBCS operational procedures.

Consultants

Jim Warner (Colorado State University) - modeling of the North Boundary
System

HLA - hydrologic and geochemical assessment and review of
reports and Technical Plan

Reports Produced	RIC #	Date
Technical Plan, Draft Final	87014R25	3/87
Technical Plan, Final		ongoing
Response Actions		forthcoming



TASK 36 STUDY AREA

RI SUMMARY

Task Number:	38	Date:	11/02/87
Task Name:	Western Tier TCE Study		
PMO Contact:	Charlie Scharmann		
Medium:	Soils, water		
Award Date:	July, 1986		
Budget:	\$1,361,952		
Prime Contractor:	Ebasco Services, Inc.		

Objectives

The objectives of Task 38 are to perform field and literature investigations of the Western Tier of RMA in order to support current litigation between the United States and the state of Colorado; determine the source(s), if any, of TCE in the Western Tier of RMA; if a source exists, define the contaminant plume between the source and the RMA boundary; and estimate the present contribution of TCE concentration from RMA to the offpost South Adams County TCE contamination.

Scope-of-Work

Task 38 includes the compilation of all historical information regarding TCE storage and usage in the western third of the arsenal, sampling of 36 soil borings, installation of 32 groundwater monitoring wells, 2 separate soil gas surveys, a geophysical program, water level measurements from 45 wells, and groundwater sampling. Site 4-6 was also investigated under Task 38.

Petrex static tube soil gas samplers were placed at about 1,000 locations throughout the Western Tier. 256 Tracer Research soil gas samples were collected and analyzed for TCA, TCE, and PCE. 27 of these were analyzed for benzene, toluene, ethyl benzene, and xylenes.

Soil samples are being analyzed for standard Phase I compounds including volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA). Water samples are being analyzed for volatile halogenated organics (GC/CON), volatile aromatic organics (GC/PID), DBCP (GC/ECD), and nitrates (technicon).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
Petrex, Inc.	-	soil gas
Tracer Research, Inc.	-	soil gas
ITECH	-	surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final		ongoing
Report on Soil Gas Results, Final		ongoing

Contamination Assessment Report:

<u>Site</u>	<u>Name</u>	<u>RIC#</u>	<u>Date Produced</u>
4-6	Motor Pool Area		ongoing

RI SUMMARY

Task Number: 39
Task Name: Offpost RI/FS
PMO Contact: Charlie Scharmann
Medium: Air, Soil/Sediment, Biota, Ground
Water, Surface Water
Award Date: Fall 1986
Budget: \$1.89 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Date: 12/03/87

Objectives

Conduct an RI/EA/FS in the offpost study area (see figure).
Determination of contaminant distribution for input to an EA as support for the FS. Primarily concerned with ground water contamination although air, soil/sediment, biota, and surface water will be considered. Product of task will be support for a Record of Decision.

Scope-of-Work

Approximately 15 to 20 wells and coreholes will be drilled in the offpost study area north of RMA. The wells will be drilled into the alluvial and deeper aquifers. Two sampling events will be conducted and the samples will be analyzed for target analytes. Surface water, soils, and sediments will be sampled during future investigations. Air and biota sampling are not anticipated at this time.

Based upon the results of the sample analyses during the RI, an EA and FS will be conducted. The FS will be oriented toward protection of human health and the environment by remediation of contaminated ground water. If during the RI other exposure pathways indicate danger to the public or environment, the EA and FS will address these exposure routes.

Consultants

HLA - field work, report preparation
Boyles Brothers - drilling
ITECH - surveying

Reports	RIC #	Date Produced
Technical Plan		ongoing
Offpost Interim Action Assessment Report, Draft Final		07/87
RMA Offpost Assessment, Ground Water Quality Report (Domestic Use Phase III) for Sampling Period September through October 1986 and February 1987		08/87
Technology Screening, Draft Interim Report		09/87
RI Contamination Assessment Report		forthcoming
EA Contamination Assessment Report		forthcoming
FS Contamination Assessment Report		forthcoming

RI SUMMARY

Task Number: 42 Date: 11/02/87
Task Name: North Plants Phase I Contamination Assessment
PMO Contact: Juan Lopez
Medium: Soils, groundwater
Award Date: September, 1986
Budget: \$744,347
Prime Contractor: Ebasco Services, Inc.

Objectives

Due to time and financial constraints, only a Phase I investigation will be conducted under this contract. If a Phase II investigation is deemed necessary, based on Phase I results, it will be conducted under a separate contract.

The objectives of the Phase I investigation is to assess if spill sites may have contaminated soils and/or groundwater in North Plants, and, if so, what chemicals are present.

Specific objectives included:

- o To assess whether potential soil or groundwater contamination exists in the North Plants area and to identify the constituents present;
- o To conduct a preliminary evaluation of the vertical and horizontal extent of contamination present within the main manufacturing and demilitarization area of the North Plants; and
- o To provide the basis for design of a quantitative Phase II (if necessary) contamination assessment program, to be conducted under a separate contract.

Scope-of-Work

The Task 42 investigation includes the compilation of all historical information regarding potential soil and groundwater contamination in the North Plants area; collection of additional data from soil borings; installation and sampling of new groundwater monitoring wells; and evaluation of all data and information collected to assess the magnitude and extent of contamination in sources and uncontaminated areas within the fenced area of North Plants. Efforts will be concentrated on locating spill sites, but the effort will also include a regional study of this area.

In the Phase I program, a total of 55 borings will be drilled with the fenced boundaries of the North Plants. Five of the borings will be converted to monitoring wells. Approximately 26% of the remaining 50 soil borings will be drilled to the top of the uppermost saturated zone.

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The soil samples are being analyzed for the standard Phase I compounds, in addition to chemical agent degradation products. The water samples will be analyzed for the standard Phase II liquid analytes, excluding specific pesticide-related analyses.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final		ongoing
Contamination Assessment Report		ongoing

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RI SUMMARY

Task Number: 44 **Date:** 12/03/87
Task Name: RMA Onpost/Offpost Ground/Surface Water
Monitoring Program
PMO Contact: Darrel Smith
Medium: Water
Award Date: March 19, 1987
Budget: \$3.6 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

As part of the environmental investigation at RMA, the necessity of establishing a litigation-quality data base for surface and ground water has been recognized. Task 4 addressed part of this need by providing baseline data to assess contaminant distributions at RMA.

Under Task 4, three rounds of water samples were collected over a 1-year period within RMA to achieve the following objectives:

- o Satisfy compliance-oriented regulatory requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the 1976 Resource Conservation and Recovery Act (RCRA), and the intent of the Cease and Desist Order;
- o Confirm the existence and chemical nature of contamination and monitor any changes in the lateral and vertical extent of contamination; and
- o Develop a core data base for use in upcoming litigation and Remedial Investigation/Feasibility Study analyses for RMA.

Task 44 was developed using the core Task 4 objectives, however, the scope of the task has been broadened to address other salient items that were beyond the scope of Task 4.

The objectives of Task 44 as detailed in the Delivery Order are to:

- o Assess the distribution and concentration levels of ground water contaminants and monitor changes in water quality with respect to these contaminants for both the onpost and offpost areas using established contaminant guidance levels;
- o Monitor and evaluate changes in water levels;
- o Evaluate data and recommend program modifications to this or other water monitoring tasks; and
- o Identify areas of significant public exposure by comparison of offpost water quality results with current guidance levels.

In order to satisfy the primary goals of the task, certain ancillary objectives will be accomplished. Additionally, these efforts will further define the Task 44 scope-of-work (SOW):

- o Utilize available geologic data to further define the current understanding of the geologic conditions present at RMA;

- o Summarize the hydrogeologic conditions in the onpost and offpost areas by integrating existing hydrologic, geologic, and water quality data;
- o Assess the distribution of contaminants in aqueous media and identify the primary hydrogeologic pathways by which contaminants are being transported to the RMA boundary or the offpost area;
- o Evaluate the existing monitoring program for data deficiencies and assess the need for additional wells; and
- o Integrate all data from water related tasks and supply appropriate information to Task 23 efforts including data bases, contaminant plume maps, and hydrogeologic assessments.

Task 44 will establish the hydrologic core data base for and provide to the EA and FS groups adequate interpretation and characterization of hydrologic, geologic, and geochemical data so that their specified goals can be achieved.

The overall Task 44 program will be designed to be dynamic in nature and will be modified, as required, in response to ongoing data evaluation and/or changes in the SOW or task objectives. Task 44 will form the base or trunk hydrologic program, while other efforts (Tasks 25, 36, 38, 39, etc.) will be tributary or branch efforts which will satisfy specific individual task needs, as well as augment the Task 44 program.

In addition to 27 sq mi of onpost area covered by Task 44, 14 sq mi of the offpost area are being monitored (see figure). The offpost area extends northwestward from RMA to the South Platte River. Several other detailed ground water tasks address localized areas within the Task 44 study area.

Scope-of-Work

The purpose of this task is to perform a hydrologic assessment for the RMA onpost and offpost areas. This assessment includes development of a baseline program for hydrologic and contamination surveillance. Network design is followed by collection of surface water and ground water samples, measurement of hydrologic parameters, and chemical analysis of water samples. These data will be evaluated to document the extent of contamination, the hydrologic and geologic conditions of the site, areas of public health exposure, potential contaminant migration pathways, and areas where additional data are required.

The scope of the Task 44 water quantity/quality survey includes completing a semiannual and/or quarterly ground water and surface water monitoring program capable of satisfying the various regulatory requirements, developing litigation-quality data to be added to the current data base, and assessing the extent and nature of contamination. In order to achieve these objectives, work in six distinct technical areas is anticipated. These areas are as follows:

- o Review the historical data;
- o Develop a monitoring program to achieve the objectives in Section 1.2 of the Task 44 Technical Plan;
- o Execute the monitoring program utilizing litigation-quality sampling and analytical procedures;

- o Assess data after the first sampling event for possible adjustments in the sampling and/or analytical scheme;
- o Compile and interpret the accumulated data at the end of the sampling program; and
- o Coordinate with and integrate data from other current ground water tasks such as Tasks 25, 26, 36, 38, and 39.

During review of the historical data, a large number of wells were evaluated with respect to construction detail, sampling history, and location. Criteria for evaluating these wells are described in Sections 3.1.1 through 3.1.2 of the Task 44 Technical Plan.

The following work was conducted to help design the Task 44 monitoring network. As previously discussed, this network will include wells from the 360° Monitoring Program, Basin F, and offpost sampling programs. Borehole logs and geologic cross sections were examined to establish a preliminary evaluation of subsurface geology. Water-level data from the Task 4 program were examined to establish directions of ground water flow within the alluvium and to aid in the correlation of permeable units within the Denver Formation. Water-quality information from Task 4 and, as appropriate, from the historical data base were examined to formulate an assessment of the distribution of contaminants within the RMA ground water system. These contaminant distribution assessments will be modified as additional information is obtained and interpreted. A preliminary assessment of hydrogeologic conditions was used to design the proposed Task 44 well network. A detailed review of well selection methodology is discussed in Section 3.1.1 of the Task 44 Technical Plan.

All ground water monitoring wells and surface water sampling sites will be sampled using uniform sampling methods. Ground water and surface water samples will be analyzed for a predetermined list of analytes including numerous organic and inorganic parameters (see table). Sample collection, measurement of field parameters, and analysis of samples will be performed in accordance with USATHAMA Quality Assurance/Quality Control procedures. These procedures include collection of field quality control samples and decontamination of all sampling equipment. Collection procedures are presented in Section 3.2 of the Task 44 Technical Plan.

All studies under Task 44 will be performed in accordance with the requirements and technical specifications discussed in Section C-3 and Appendices A (USATHAMA Quality Assurance Program, 1982, RIC#87048R03) and B (USATHAMA Geotechnical Requirement, 1983), except where modified as required for technical/litigation standardization. Standardized methods, protocols, and criteria will be consistent with those performed in Tasks 1, 2, and 4 and as established during subsequent meetings between the Army and contractors. Services conducted under Task 44 will include collection, analysis, reduction, compilation, and assessment of environmental data for both surface water and ground water. Ground water elevation and water quality data will be collected on a quarterly and/or semiannual basis. Stream flow evaluations and surface water event sampling will also be conducted. Acquired data will be utilized as input into the litigation effort.

Consultants

HLA - technical support
Boyles Brothers - drilling
Frontier Logging - downhole geophysics
ITECH - surveying

Reports

RIC #

Date Produced

Technical Plan
Composite Well Program Report
Final Report

ongoing
ongoing
forthcoming

Table of Target Analytes - Task 44

Organochlorine Pesticides

Aldrin
Endrin
Dieldrin
Isodrin
Hexachlorocyclopentadiene (CL6CP)
PPDDE
PPDDT

DIMP/DMMP

Diisopropylmethylphosphonate
Dimethylmethylphosphonate

DBCP

Dibromochloropropane

Volatile Organohalogens

Chlorobenzene (CLC6H5)
Chloroform (CHCL3)
Carbon Tetrachloride (CCLA)
trans-1,2-Dichloroethylene (T12DCE)
Trichloroethylene (TRCLE)
1,1 Dichloroethylene (11DCE)
1,1 Dichloroethane (11DCLE)
1,2 Dichloroethane (12DCLE)
1,1,1 Trichloroethane (111TCE)
1,1,2 Trichloroethane (112TCE)
Methylene Chloride (CH2CL2)
Tetrachloroethylene (TCLEE)

Metals

Mercury
Arsenic
Cadmium
Chromium
Copper
Lead
Zinc

Major Cations

Potassium
Calcium
Magnesium
Sodium

Organosulfur Compounds

P-Chlorophenylmethylsulfone (CPMSO₂)
P-Chlorophenylmethylsulfoxide (CPMSO)
P-Chlorophenylmethylsulfide (CPMS)
1,4-Dithiane
Oxathiane
Dimethyldisulfide (DMDS)

Major Anions

Chloride
Fluoride
Sulfate
Nitrate+Nitrite
Alkalinity (as CaCO₃)

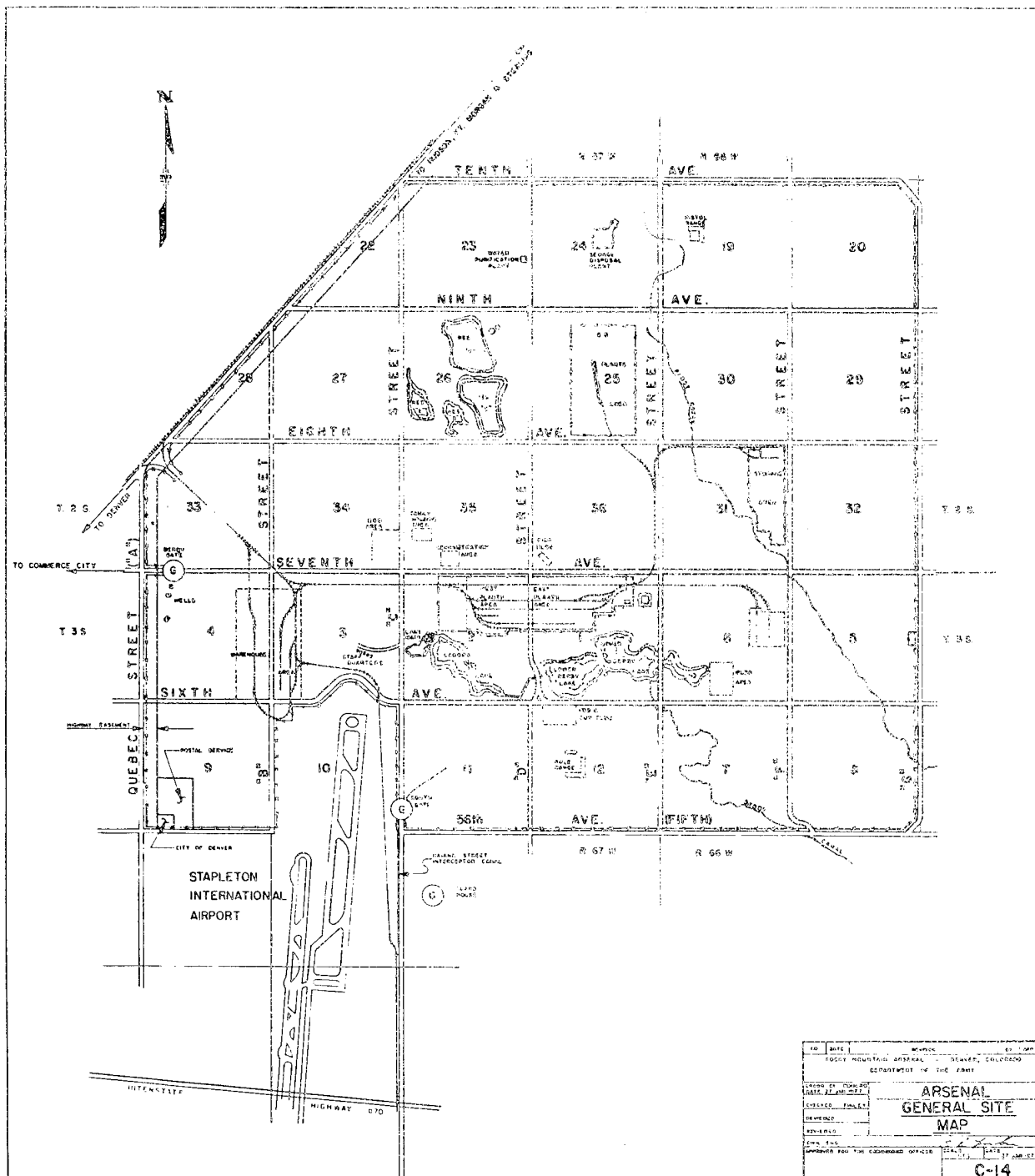
Volatile Aromatics

Toluene
Benzene
Xylene (m-)
Ethylbenzene
Xylene (o,p)

DCPD/MIBK

Dicyclopentadiene
Methylisobutyl Ketone

Source: ESE, 1987



TASK 44 STUDY AREA

RI SUMMARY

Task Number: 47 Date: 12/03/87
Task Name: Phase II Northern Surveys
PMO Contact: Kevin Blose
Medium: Soil/Water/Air
Award Date: June 26, 1977
Budget: \$1.99 million
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

This task will provide additional site-specific and media-specific support for both the ongoing Remedial Investigation and the Feasibility Study.

Scope-of-Work

This task will provide overall program management support for both ESE and HLA key personnel. The development of the RI/FS Plan will be managed and produced under this project.

The three study area reports for the Central, North Central, and Eastern areas will be managed and funded by this task. The FS Reports will also be funded under this task.

Other special requirements for support will also be managed as they are defined by the earlier tasks. These efforts will be documented in letter technical plans as they are defined and approved.

Consultants

HLA - general and project specific management, report generation, and documentation support

Reports

	<u>RIC #</u>	<u>Date Produced</u>
Central Area Report		forthcoming
North Central Area Report		forthcoming
Eastern Area Report		forthcoming

RI SUMMARY

Task Number: 48 Date: 11/02/87
Task Name: Supplementary Phase II Surveys on the Southern
Sections of RMA
PMO Contact: TBA
Medium: Soils, water
Award Date: June, 1987
Budget: \$2,263,254
Prime Contractor: Ebasco Services, Inc. .

Objectives

The objective of Task 48 is to perform supplementary Phase II surveys of sites located in North Plants, the southern sections, and the western tier of RMA. Area-wide reports for the eastern, southern, and western areas, North Plants, and South Plants will be developed. Another objective is to develop a master computer database for use by all RI/FS contractors.

Scope-of-Work

Task 48 will collect site-specific information upon which to base upcoming conceptual design studies for remedial action. These studies will be conducted at sites in the Western Tier, South Plants, Hydrazine Facility, North Plants, Basin A, Army Sites on the Southern portion of the arsenal, and structures and spills throughout RMA. Both soils and groundwater investigations will be conducted. A special study on the western tier is being performed in connection with UCLA.

An estimated 20 borings and 18 wells will be drilled. Soil and groundwater samples will be collected.,

The soil samples are being analyzed for volatile organics (GC/MS), volatile halogenated organics (GC), ICP metals, mercury, and arsenic. The water samples are being analyzed for volatile halogenated organics (GC), volatile aromatic organics (GC), organosulfur compounds (GC/FP), phosphonates (GC/FPD), metals (AA and ICP), thiodiglycol (HPLC), and anions (IC).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final		ongoing
Phase II Addendums for All Tasks		ongoing
Special UCLA Study Report		ongoing
Regional Study Area Reports:		
Eastern SAR		ongoing
Southern SAR		ongoing
Western SAR		ongoing
North Plants SAR		ongoing
South Plants SAR		ongoing

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FS SUMMARIES

FS SUMMARY

Task Number:	17	Date:	11/03/87
Task Name:	Incineration Feasibility Study		
PMO Contact:	Bruce Huenfeld		
Medium:	Basin F Materials		
Award Date:	February, 1986		
Budget:	\$765,305		
Prime Contact:	Ebasco Services, Inc.		

Objectives

The objectives of Task 17 are to: (1) determine the incinerability of Basin F soils using a nonflame mode incinerator; (2) select an appropriate incineration technology; (3) make recommendations on the utilization of a pilot plant; and (4) develop a conceptual design for an incineration facility capable of thermally treating Basin F soils. A laboratory expansion program is also underway to determine the incinerability of Section 36 soils, including those in Basin A.

Scope-of-Work

The scope of work involves the development of technical reports for the laboratory determination of soil incinerability, technology selection, pilot plant recommendations, and conceptual design. In addition, a management plan, technical plan, and laboratory plan were prepared. The scope of the four technical reports is summarized below.

The laboratory determination of soil incinerability is utilized to determine the incinerability of the Basin F soils using a bench scale incinerator consisting of a primary chamber, afterburner, and a gas cooling and sampling system. Incinerability tests are conducted on the Basin F soils at various temperatures, residence times, and levels of excess air in both the primary chamber and afterburner. Tests to date indicate that the organic contamination in the Basin F soils is destroyed to a destruction and removal efficiency of 99.99 percent. Optimum conditions are 900°C in the primary chamber and 1,200°C and a 2 second gas residence time in the afterburner, both at 7 percent excess air.

The technology selection report reviews all current incineration technologies including rotary kiln, fluidized bed, multiple hearth, plasma, molten salt, molten glass, and other systems. From these systems, three technologies are ultimately selected for a detailed investigation of their applicability to Basin F soils. The selected technologies are the rotary kiln, fluidized bed, and multiple hearth incinerators. The rotary kiln followed by an afterburner is selected as the most appropriate technology by a paired comparison technique, since it handles a wide range of wastes, operates under a wide range of conditions, and operates under negative pressure.

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The pilot plant report evaluates the advantages and disadvantages of the following options: (1) constructing the full scale facility directly from laboratory testing without a pilot plant, (2) using Building 1611 as a pilot plant, (3) using an off-site pilot plant, and (4) constructing an on-site pilot plant. The no pilot plant option is rejected since it does not represent good engineering practice. The use of the Building 1611 incinerator is rejected since it is in a state of disrepair and is not capable of achieving the required kiln and afterburner conditions. The off-site pilot is rejected because of scheduling, permitting, and transportation concerns. The on-site pilot plant is ultimately selected since it replicates the full scale system and since there are no transportation or scheduling concerns.

The design report includes a conceptual level evaluation of a full-scale hazardous waste incinerator for the treatment of Basin F soils. The report includes a method of excavation; flow diagrams; general arrangement, elevation, and plot plan; a detailed facility description; a capital and O&M cost estimate; and a schedule. All engineering calculations are provided in extensive appendices. Facility alternatives, including the use of an indirect fired kiln, different kiln conditions, various fuel types, and various equipment concerns are also presented.

Besides the four reports described above, another laboratory report is under development for Section 36 soils including Basin A soils. The purpose of this report is to evaluate the incinerability of Section 36 wastes and also to evaluate low temperature volatilization in the primary chamber. Preliminary experimental results indicate the complete volatilization does occur at conditions less than 900°C in the primary chamber.

Consultants

Hittman-Ebasco	- laboratory analyses
New Enterprise Technologies	- thermal destruction unit
Dr. Barry Dillinger - Midwest Research Institute	- results interpretation

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	86239R01	06/86
Laboratory Test Plan for Incineration of Basin F Wastes at RMA	86239R02	06/86
Selection of Incineration Technology for Basin F Wastes of Rocky Mountain Arsenal	87007R17	09/86*
Analysis of Pilot Plant Alternatives for the Incineration of Basin F Wastes		03/87*

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<u>RIC#</u>	<u>Date Produced</u>
Bench Scale Laboratory Incineration of Basin F Wastes	05/87*
Full Scale Incineration System Concept Design for Basin F Wastes	04/87*
Technical Plan Task 17 Expansion Program	03/87*
Bench Scale Laboratory Incineration of Section 36 Wastes at Rocky Mountain Arsenal	ongoing

* - draft final

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FS SUMMARY

Task Number: 26 Date: 11/02/87
Task Name: Groundwater Treatment Study/Interim Action Assessment,
South Plants Area and Basin A Neck
PMO Contact: Greg Briggs
Medium: Groundwater
Award Date: July, 1986
Budget: \$478,965
Prime Contractor: Ebasco Services, Inc.

Objectives

The objective of Task 26 is to evaluate the groundwater flow systems in the South Plants, Basin A, and Basin A Neck region and to identify areas in this region for implementing Interim Response Actions.

Scope-of-Work

The focus of the task has been revised from a feasibility study evaluating the groundwater flow systems and developing conceptual groundwater collection and treatment systems for the South Plants and Basin A areas to performing an Interim Action Assessment in these areas. Additionally, the well installation and geophysical logging program included under the original focus of Task 26 will be completed.

The overall objective of the Interim Response Action Assessment is to identify logical, reasonable, and beneficial response actions which can be implemented prior to the final remedy for RMA and which will minimize long term, adverse impacts of identified problem areas.

Specifically, the objectives of the study are:

- o To identify hot spots, source areas, and groundwater flow conduits for potential interim response actions;
- o To identify benefits derived from implementing the interim response actions; and,
- o To evaluate applicable remediation and/or treatment options.

Consultants

R.L Stollar and Associates	-	field work, reports
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
COLOG	-	borehole geophysics
ITECH	-	surveying

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Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87007R42	12/86
Interim Response Action Assessment, Draft Report		09/87

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FS SUMMARY

Task Number:	27	Date:	11/02/87
Task Name:	Hazardous Waste Land Disposal Facility		
PMO Contact:	Ken Wiggans		
Medium:	N/A		
Award Date:	March, 1986		
Budget:	\$476,222		
Prime Contractor:	Ebasco Services, Inc.		

Objectives

The objective of Task 27 is to identify a site or sites within the Arsenal boundaries, and develop a concept for a land disposal facility capable of containing all contaminated material at RMA. An additional objective is to provide an assessment of compliance with regulatory requirements and an estimate of cost of such a facility.

Scope-of-Work

The scope of work for Task 27 is as follows:

- o Review available literature and documents, including the most current data available in the remedial investigation (RI), to define and characterize the volumes and types of wastes requiring remediation;
- o Select the most suitable site(s) available on RMA based upon the optimum combination of geologic, geographic, health, environmental, and economic considerations consistent with the requirements of the National Contingency Plan (NCP);
- o Select design criteria to be used for the assessment;
- o Review literature to consider the technology available for waste cells, evaluate the various concepts, and select optimum waste cell concepts;
- o Evaluate various land disposal facility layouts and select the layouts best suited to each specific disposal site;
- o Prepare an assessment to provide a basis for construction schedules and cost estimates;
- o Develop a preliminary schedule and cost estimate for the construction of the facility;
- o Develop guidelines for waste cell construction specifications, and quality assurance procedures;

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- o Prepare a report describing the waste sources, site selection rationale, facility and waste cell concept configurations, estimated construction quantities and costs, guideline construction specifications and quality control procedures.

Consultants

QC Data - computer database

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Final	87196R07	07/87
Draft Final Report		09/87
Final Report		ongoing

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FS SUMMARY

Task Number: 28 Date: 12/03/87
Task Name: Feasibility Study-Alternative Analysis
PMO Contact: Charlie Scharmann
Medium: N/A
Award Date: June 1986
Budget: \$694,450
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Task 28 will identify candidate technologies, candidate alternatives, selected alternatives, preferred alternatives, and the final recommended response action for remediation of the regional areas located at RMA. The recommended response action will be made after screening of available technologies, and screening and evaluation of alternatives are completed.

Scope-of-Work

Literature searches of available technologies will be performed. Sources to be considered will include manufacturers literature and other FS studies. Once the literature search has been completed and available technologies identified, screening of the technologies will be performed. Alternatives will be developed using the accepted technologies. Alternative screening will be done in order to eliminate inappropriate actions for the different study areas based on media and contaminants present at RMA. Alternative evaluation will examine the screened alternatives in more detail using a more extensive set of criteria. The alternatives selection process will culminate with a report presenting Recommended Response Actions.

Consultants

None

Reports

	<u>RIC #</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87014R12	10/86
Technology Screening, Interim Report		ongoing
Recommended Response Actions Report		forthcoming

FS SUMMARY

Task Number: 30 Date: 12/03/87
Task Name: Building 1727 Sump Interim Response Action Assessment
PMO Contact: Greg Briggs
Medium: Structures
Award Date: September 1986
Budget: \$150,143
Prime Contractor: Environmental Science and Engineering, Inc. (ESE)

Objectives

Develop interim response action for treating and disposing of the water contained in Sump 1727 while a longer term solution is developed for handling the water inflow to the sump. Determine cost-effective measures for eliminating or minimizing inflow to the sump, and conditions of the sump relative to the possible future use of the sump in demilitarization activities. Develop long-term solution for handling water inflow to the sump.

Scope-of-Work

Review existing information concerning potential sources of inflow to Sump 1727 (e.g., construction plans of chemical sewers leading to the sump). Perform treatability study of the Sump 1727 water to develop design of interim response action for treating and disposing of the water until a longer term solution can be developed. Conduct an engineering field survey to identify sources of inflow to the sump and develop recommended measures for eliminating or minimizing the inflow. In addition, the condition of the sump will be assessed in the survey relative to possible future use of the sump in demilitarization activities.

Consultants

None

Reports

	RIC Number	Date Produced
Technical Plan		ongoing
Draft Final Treatability Study Report		7/87

FS SUMMARY

Task Number: 31 Date: 11/03/87
Task Name: Basin F Interim Response Action Support
PMO Contact: Ali Alavi
Medium: Soil, liquid, water
Award Date: June, 1987
Budget: \$108,743
Prime Contactor: Ebasco Services, Inc.

Objectives

The purpose of Task 31 is to provide support for the supplemental Basin F interim action activities conducted by the PM-RMA. Specific work assignments are performed at the request of PM-RMA.

Scope-of-Work

Task 31 will include, but may not be limited to, the following activities: sampling and analysis of soil, liquid, surface water and groundwater in and around Basin F; technical assessments of proposed Basin F Interim Response Actions; measurement of the liquid level and estimation of the volume in Basin F; assessment of liquid in the southern pools of Basin F to determine if that liquid can be treated by conventional means, and not as Basin F liquid; and assessment of the risk to human health resulting from off-gassing during Basin F Interim Response Actions.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final		09/87
Technical Plan, Final		ongoing
Southern Pool Assessment Report		ongoing
Preliminary Risk Assessment for Basin F Volatiles, Draft Report		09/87
Basin F Volume Report		ongoing

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FS SUMMARY

Task Number: 34 Date: 11/03/87
Task Name: Hydrazine Facility Wastewater Treatment and
Decommissioning Assessment
PMO Contact: Ken Wiggans
Medium: Wastewater
Award Date: May, 1986
Budget: \$201,363
Prime Contractor: Ebasco Services, Inc.

Objectives

The objective of Task 34 is to determine the best technology available for treating hydrazine contaminated water, and provide a plan and cost estimate to decommission the facility. Criteria of technical feasibility, level of treatment, institutional requirements, and cost were used to compare the options for wastewater treatment.

Scope-of-Work

The scope of Task 34 is to prepare a detailed decommissioning plan for the facility and alternatives for treating and disposing of wastes and wastewater. Four candidate technologies were evaluated in detail: ozone/UV, hydrogen peroxide/UV, evaporation pond, and incineration.

Consultants

Illinois Insitute of Technology	
Research Institute	- treatability studies
DataChem	- chemical analyses

Reports

	<u>RIC#</u>	<u>Date Produced</u>
Technical Plan, Draft Final	87007R33	12/86
Draft Final Report		9/87
Final Report		ongoing

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TED SUMMARY

Task Number: TED-8
Task Name: Evaluation/Selection/Testing of Innovative Technologies
for Basin F Materials
PMO Contact: Charles Scharmann
Medium: Basin F Liquid/Sludges/Soils
Award Date: July 1986
Budget: \$532,750
Prime Contractor: Arthur D. Little, Inc.

Objectives:

The objectives of this task were to: review the industrial data base for promising hazardous materials treatment technologies; evaluate the candidate technologies for use in the treatment of Basin F material; select and complete laboratory testing for the most promising technologies; and prepare a preliminary process design and cost estimate for the technologies tested.

Scope-of-Work

Task TED-8 evaluated 18 different innovative treatment technologies for their application to Basin F waste. The technologies evaluated included: advanced combustion, biochemical, circulating bed combustion, electropyrolysis, encapsulation, extraction, fluidized bed combustion, glassification, infrared radiation, in-situ vitrification, organic stripping, pyroplasma, rotary kiln incineration, sintering, soil washing, supercritical water, synfuels technology, and wet-air oxidation. Of these technologies, three (glassification, soil washing, and circulating bed combustion) were selected for laboratory testing and further evaluation.

Due to permitting problems at the circulating bed combustion test facility, laboratory tests were not able to be completed for the technology; however, laboratory tests were successfully completed for glassification and soil washing. Data resulting from these tests will be incorporated into a final report which will provide a preliminary process design and cost estimate for each technology tested and a recommendation on whether these technologies are feasible for the treatment of Basin F wastes.

Consultants

Battelle Pacific Northwest Laboratories	- glassification
MTA Remedial Resources, Inc.	- soil washing

SHELL/HRO/MKE SUMMARIES

HOLME ROBERTS & OWEN

ATTORNEYS AT LAW

SUITE 400
102 NORTH CASCADE AVENUE
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TELECOPIER 861-4578
TELEX 45-4460

DENVER TECHNOLOGICAL CENTER
SUITE 900
8400 EAST PRENTICE AVENUE
ENGLEWOOD, COLORADO 80111

SUITE 400
1401 PEARL STREET
BOULDER, COLORADO 80302

EDWARD J. McGRATH

November 6, 1987

Ms. Karen Knirsch
R. L. Stollar & Associates
143 Union Blvd., Suite 1010
Lakewood, CO 80228

Re: United States v. Shell Oil

Dear Karen:

Enclosed please find project descriptions for work performed
by the Shell/HRO/MKE team on the RMA project.

With best regards,

Sincerely yours,

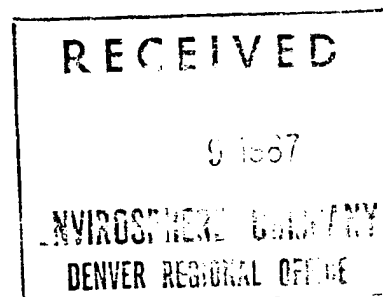


Edward J. McGrath

EJM/jy/14262

Enc.

cc: T. Bick
S. Isaacson
D. Campbell
P. Chiarro



ADMINISTRATIVE/MANAGEMENT/COMPUTER SUPPORTALL PROJECT SUPPORT ACTIVITIES:

- PURPOSE - TO PROVIDE THE NECESSARY MANAGEMENT AND SUPPORT INHERENT TO THE COST EFFECTIVE OPERATION AND CONTROL OF THE PROJECT. SPECIFIC ONGOING TASKS ESSENTIAL TO PROJECT ACTIVITIES INCLUDE MANAGEMENT SUPPORT, ADMINISTRATIVE SUPPORT, COMPUTER SUPPORT, AND INDUSTRIAL HYGIENE COMBINED WITH SITE SAFETY. THE ADMINISTRATIVE SUPPORT ITEM IS FURTHER DETAILED TO INCLUDE ACCOUNTING, SUBCONTRACT ADMINISTRATION, CLERICAL SUPPORT, PROJECT COST AND SCHEDULE CONTROL, PROJECT SECURITY, AND QA/QC. COMPUTER SUPPORT NOT ONLY CONSISTS OF DATA BASE SUPPORT AND OPERATIONS, BUT ALSO GEOGRAPHIC INFORMATION SYSTEM OPERATION.

RISK ASSESSMENTRISK ASSESSMENT:

- **PURPOSE** - TO PROVIDE SUPPORT TO SHELL AND HRO IN ADDRESSING ISSUES AND STRATEGIES CONCERNING CLEANUP OF THE ROCKY MOUNTAIN ARSENAL. SEVERAL TASKS HAVE ALREADY BEEN COMPLETED. COMPLETED TASKS INCLUDE THE DEVELOPMENT OF A COMPUTERIZED DATA BASE LISTING CHEMICALS BELIEVED TO HAVE BEEN PRODUCED, USED, OR DISPOSED AT ROCKY MOUNTAIN ARSENAL. COMPLETED TASKS INCLUDE CONDUCTING A LITERATURE SEARCH ON 762 CHEMICALS, DETERMINING SHORT LIST CHEMICALS (379 TOTAL), AND RANKING OF CHEMICALS. INFORMATION HAS BEEN INPUT INTO A COMPUTER DATA BASE. MAINTENANCE AND UPDATE OF THE DATA BASE CONTINUES. COMPLETED TASKS ALSO INCLUDE THE WRITING OF THE "HOW CLEAN IS CLEAN" POSITION PAPER, DEVELOPMENT OF A HAZARD RANKING DOCUMENT, REVIEW OF THE ARMY PPLV MODEL, REVIEW OF THE ARMY PROPOSED ENDANGERMENT ASSESSMENT PROCESS, AND REVIEW OF ARMY CRITERIA FOR EVALUATION OF OFF-POST WATER QUALITY. OTHER TASKS INVOLVE ONGOING ACTIVITIES SUCH AS DEVELOPING AN ARARS DATA BASE, PARTICIPATING IN A SUBCOMMITTEE FOR TASK 35 ("HOW CLEAN IS CLEAN"), AND ASSISTING HRO IN DEVELOPING A POSITION ON CLEANUP CRITERIA TO SUPPORT THE SHELL REMEDIAL PLAN.

11/05/87

NATURAL RESOURCESAQUATIC STUDIES:

- PURPOSE - TO PERFORM POPULATION AND TISSUE CONTAMINATION STUDIES, AND ALSO TO COLLECT SURFACE WATER QUALITY DATA AND DETERMINE ANY CONTAMINANT DISTRIBUTION IN SEDIMENTS. THE PHASE I AQUATICS STUDIES, WHICH INCLUDED LITERATURE REVIEW AND RECONNAISSANCE, ARE COMPLETE. CURRENT PHASE II AQUATICS STUDIES INVOLVE FIELD STUDIES WITH CHEMICAL ANALYSIS.

11/05/87

NATURAL RESOURCESWILDLIFE STUDIES:

- PURPOSE - TO PERFORM POPULATION STUDIES OF WILDLIFE SPECIES AT THE ROCKY MOUNTAIN ARSENAL AND OFF SITE CONTROL LOCATIONS, INCLUDING THE DETERMINATION OF SPECIES OCCURRENCE, DISTRIBUTION, AND ABUNDANCE WITH AN EMPHASIS ON HABITAT RELATIONSHIPS AND PROXIMITY TO ANY CONTAMINATION SOURCES. THE PHASE I WILDLIFE STUDIES, WHICH INCLUDE LITERATURE REVIEW AND RECONNAISSANCE, ARE COMPLETE. ONGOING PHASE II WILDLIFE STUDIES INVOLVE FIELD STUDIES WITH TISSUE ANALYSIS.

11/05/87

NATURAL RESOURCES**VEGETATION STUDIES:**

- **PURPOSE - TO QUALITATIVELY AND QUANTITATIVELY DESCRIBE VEGETATION AT THE ROCKY MOUNTAIN ARSENAL, AND TO ASSESS WHETHER COMMUNITY-LEVEL CONTAMINATION EFFECTS EXIST, AND ANY RELATIONSHIPS TO SOILS AND WILDLIFE. PHASE I VEGETATION STUDIES ARE COMPLETE. THESE STUDIES CONSISTED OF SPECIES ANALYSIS AND CHARACTERIZATION.**

11/05/87

NATURAL RESOURCESSOILS STUDIES:

- PURPOSE - TO DETERMINE SOIL TYPE DISTRIBUTION AND PHYSIOCHEMICAL CHARACTERISTICS, AND TO EVALUATE HORIZONTAL AND VERTICAL DISTRIBUTION OF ANY CONTAMINANTS AT THE ROCKY MOUNTAIN ARSENAL. THE PHASE I SOILS STUDIES TO IDENTIFY SOIL TYPES AND AREAS OF IMPORTANCE ARE COMPLETE. PHASE II SOILS STUDIES TO IDENTIFY CONTAMINATION DEPTH PROFILES ARE ONGOING ACTIVITIES AS WELL AS THE SOILS MICROBIOTA PROGRAM, SOILS MAPPING, AND EVALUATION OF THE EFFECTS OF PREFERRED REMEDIAL ACTIONS.

11/05/87

HYDROLOGIC ACTIVITIESCORE LEACHING STUDY:

- PURPOSE - TO DETERMINE THE FEASIBILITY OF LEACHING SPECIFIC TYPES OF CONTAMINANTS THROUGH THE SOIL AND THEN TREAT BY GROUNDWATER TREATMENT FACILITIES. SITES HAVE BEEN SELECTED FOR FIELD SAMPLING AND A FIELD SAMPLING PLAN IMPLEMENTED. THE ANALYTICAL ANALYSIS OF CORE SAMPLES IS AN ONGOING TASK.

11/05/87

HYDROLOGIC ACTIVITIESHYDROLOGIC MODELING/GROUNDWATER FLOW EVALUATION:

- **PURPOSE** - DEVELOP ANALYTICAL OR MATHEMATICAL MODELS TO DESCRIBE FLOW PATTERNS ON THE ROCKY MOUNTAIN ARSENAL AND OFF POST AS NECESSARY. EXISTING GROUNDWATER FLOW MODELING ACTIVITIES PERFORMED IN THE ARSENAL AREA HAVE BEEN EVALUATED. PARAMETERS FROM THE GROUNDWATER DATA BASE WERE THEN SELECTED FOR USE IN COMPUTER MODELING. COMPUTER MODELS FOR GROUNDWATER FLOW WERE ALSO EVALUATED TO DETERMINE APPROPRIATE CODES FOR GROUNDWATER MODELING AT THE ARSENAL. OTHER TASKS COMPLETED WERE THE DETERMINATION OF A SOIL MOISTURE COMPONENT FOR USE WITH A NUMERICAL CODE, AND THE UTILIZATION OF A MODEL (M.O.C.) TO EVALUATE FLOW PATTERNS IN THE ARSENAL AREA AND THE CREDIBILITY OF PREVIOUS EFFORTS. MODEL DEVELOPMENT AND UTILIZATION IS AN ONGOING ACTIVITY TO DETERMINE THE IMPACT OF OFF POST ACTIONS ON THE BOUNDARY SYSTEMS IN AREA "A".

11/05/87

GEOLOGIC ACTIVITIESPRE-1942 WELLS:

- **PURPOSE** - TO DEVELOP A PROGRAM TO LOCATE WELLS THAT WERE IN EXISTENCE PRIOR TO THE ARMY'S ACQUISITION FOR THE ROCKY MOUNTAIN ARSENAL PROPERTY IN 1942. ARMY RECORDS, ASSESSORS' REPORTS, USGS REPORTS, AND AERIAL PHOTOGRAPHS (CIRCA 1937) HAVE BEEN REVIEWED, AND A MAP WAS CONSTRUCTED SHOWING THE INDIVIDUAL PROPERTIES AS EXISTING IN 1942. WELLS WERE PLOTTED AND DESCRIBED TO THE EXTENT POSSIBLE. ALSO, THE DEVELOPMENT OF A PROGRAM TO LOCATE AND TREAT WELLS HAS BEEN COMPLETED. COORDINATION WITH THE ARMY IN LOCATING AND POSSIBLY SAMPLING WELLS IS AN ONGOING ACTIVITY.

11/05/87

GEOLOGIC ACTIVITIESON-SITE DRILLING PROGRAM:

- PURPOSE - TO DETERMINE THE LIMITS OF SPECIFIC PLUMES IN THE VICINITY OF FIRST CREEK, BASIN A, AND SOUTH PLANTS AREAS AT THE ROCKY MOUNTAIN ARSENAL. HOLES HAVE BEEN DRILLED IN THE SPECIFIED AREA AND GEOLOGIC INFORMATION LOGGED. WATER SAMPLES AND LEVEL READINGS WERE TAKEN. INFORMATION WAS INPUT INTO THE GEOLOGIC DATA BASE AND SPECIFIC MAPS REVISED AS REQUIRED.

11/05/87

GEOLOGIC ACTIVITIES

GEOLOGIC DATA BASE:

- **PURPOSE** - DEVELOP A COMPUTERIZED DATA BASE FROM WHICH GEOLOGIC DATA CAN BE RETRIEVED FOR USE IN CONSTRUCTING VARIOUS MAPS AND CROSS SECTIONS DEPICTING THE GEOLOGIC PROPERTIES OF THE ROCKY MOUNTAIN ARSENAL. ALL AVAILABLE DATA FROM VARIOUS AGENCIES HAS BEEN COMPILED AND INTERPRETED. DATA WAS FORMATTED AND ENTERED IN A DATA BASE. ALSO, THE DEVELOPMENT OF A GEOLOGIC BASE MAP OF THE ROCKY MOUNTAIN ARSENAL HAS BEEN COMPLETED. THE TASK OF INTERPRETING ADDITIONAL DATA (PRIMARILY ARMY FILES) AND REVISING THE DATA BASE IS ONGOING.

11/05/87

ENGINEERING ACTIVITIESREMEDIAL ACTION ANALYSIS:

- **PURPOSE** - THE PRIMARY PURPOSE OF THIS WORK IS TO PROVIDE A TECHNICALLY SOUND AND COST-EFFECTIVE PLAN FOR THE REMEDIATION OF THE ROCKY MOUNTAIN ARSENAL TO BE CONTRIBUTED TO ARMY REMEDIAL PLANNING. THE REMEDIAL ACTION ANALYSIS INVOLVES ONGOING ACTIVITIES INCLUDING REVIEW AND CRITIQUE OF ARMY REMEDIAL ACTION PLANS, DEVELOPMENT OF A SHELL REMEDIAL ACTION STRATEGY, AND PREPARATION OF CONCEPTUAL ENGINEERING PLANS AND COST ESTIMATES. THESE CONCEPTUAL PLANS INCLUDE THE DEVELOPMENT OF A DESIGN FOR THE BASIN A NECKS AREA, WITH ASSOCIATED WATER TREATMENT FACILITY, AND A REPORT ON A LANDFILL DESIGN FOR RMA.

ENGINEERING ACTIVITIES

CLEANUP TECHNOLOGIES:

- PURPOSE - TO DEVELOP A LISTING AND PRELIMINARY ANALYSIS OF AVAILABLE AND STATE-OF-THE-ART TECHNOLOGIES APPLICABLE TO REMEDIATION OF THE ROCKY MOUNTAIN ARSENAL. A LISTING OF APPLICABLE TECHNOLOGIES HAS BEEN DEVELOPED. ONGOING ANALYSIS IS BEING CONDUCTED TO DETERMINE THE APPLICABILITY OF AND PROBLEMS ASSOCIATED WITH VARIOUS TREATMENT TECHNOLOGIES. THE TECHNOLOGIES BEING ANALYZED ARE THERMAL TREATMENT, CHEMICAL TREATMENT, AND BIOLOGICAL OR IN-SITU TREATMENT.

11/05/87

ENGINEERING ACTIVITIES

SEWER INVESTIGATIONS:

- PURPOSE - TO PROVIDE SUFFICIENT INFORMATION TO SELECT SITES FOR EXCAVATION, OBSERVATION, AND SOIL SAMPLING.

TO PROVIDE CHEMICAL SAMPLE ANALYSIS TO ASSESS HISTORICAL LEAKAGE FROM THE SEWERS.

TO PROVIDE A BASIS FOR DETERMINING CONSTRUCTION TECHNIQUES.

ALL AVAILABLE MAPS DESCRIBING RMA WASTE COLLECTION SYSTEM HAVE BEEN COMPILED. FIELD RECONNAISSANCE WAS CONDUCTED TO VERIFY MAPPED STRUCTURES, AND A COMPREHENSIVE SEWER SYSTEM MAP PREPARED. WATER SAMPLING IN FLOODED SEWER REACHES, AND AIR PRESSURE TESTING AND INTERNAL TV INSPECTION OF SELECTED REACHES HAS ALSO BEEN COMPLETED. CURRENT ACTIVITY IS CONCENTRATED ON THE PREPARATION OF AN INVESTIGATIONS REPORT.

NATURAL RESOURCESAIR QUALITY STUDIES:

- PURPOSE - THE PROGRAM CONSISTS OF THREE MAJOR COMPONENTS: A PATHWAYS ASSESSMENT RELATING AIRBORNE SOURCES CONTAMINATION INTO THE BIOSPHERE, AN AIR RESOURCE DAMAGE ASSESSMENT, AND INPUT TO REMEDIATION PLANNING SPECIFICALLY REGARDING RISK ASSESSMENT OF VARIOUS CLEANUP TECHNOLOGIES. INITIAL AIR STUDIES AND SOURCE CHARACTERIZATION IS COMPLETE. REMEDIAL PLANNING SUPPORT, PATHWAYS ASSESSMENT, AND AIR RESOURCE EVALUATION ARE ONGOING ACTIVITIES.

HYDROLOGIC ACTIVITIES

SURFACE WATER MODELING:

- **PURPOSE** - DEVELOP A SURFACE WATER MODEL TO EVALUATE SURFACE WATER DRAINAGE, AND MOVEMENT OF SURFACE WATER ONTO AND OFF OF THE ROCKY MOUNTAIN ARSENAL. VARIOUS DATA BASE INFORMATION HAS BEEN USED TO DEVELOP TRANSPORT MODELS. POTENTIAL REMEDIAL ACTIONS CONTINUE TO BE EVALUATED.

11/05/87

HYDROLOGIC ACTIVITIESDATA ACQUISITION/DATA BASE DEVELOPMENT:

- PURPOSE - TO ESTABLISH A DATA BASE TO INCLUDE GROUNDWATER LEVELS, SURFACE WATER FLOW, AND GROUND AND SURFACE WATER QUALITY DATA FOR USE IN THE EVALUATION AND ILLUSTRATION OF WATER AND CONTAMINANT MOVEMENT AT THE ROCKY MOUNTAIN ARSENAL. DATA HAS BEEN OBTAINED FROM THE ARMY, STATE, FEDERAL AGENCIES, AND INDIVIDUAL DRILLERS. THE DATA WAS REVIEWED FOR CONSISTENCY AND ADEQUACY PRIOR TO BEING ENTERED IN A COMPUTER DATA BASE. EFFORTS TO OBTAIN EPA/SACWSD DATA AS WELL AS MAINTAINING AND UPDATING THE DATA BASE ARE ONGOING.

11/05/87

ENGINEERING ACTIVITIESSPILLS LIST DATA BASE:

- PURPOSE - DEVELOP COMPUTERIZED DATA BASE SUMMARIZING ALL AVAILABLE INFORMATION ON SPILLAGE, LEAKAGE, OR DISPOSAL OF ALL CHEMICALS AT ROCKY MOUNTAIN ARSENAL. ALL AVAILABLE DOCUMENTS HAVE BEEN OBTAINED. DOCUMENT INFORMATION WAS SUMMARIZED AND INPUT INTO A DATA BASE. NOTEBOOKS CONTAINING THE DATA BASE INFORMATION WERE THEN ASSEMBLED. MAINTENANCE AND UPDATE OF THE DATA BASE CONTINUES.

11/05/87

APPENDIX B
RMA RI/FS SCHEDULE GLOSSARY AND GANTT CHARTS

RMA RI/FS SCHEDULE GLOSSARY

- Addendum: Analytical data from Phase 2 activities.
- BLUE: Draft version of a document subject to internal government review.
- BROWN: Draft final document subject to comment by PAS.
- CAR: Contamination Assessment Report. A document describing the history, remedial investigation, and potential contamination present at a particular site.
- Cont ID w/ ARARs: Contaminant identification with chemical specific ARAR determination.
- Data Assessment: Analysis of analytical data for the purpose of planning future activities.
- Data Compilation: Organizing and presenting analytical data.
- Data Integration: Assembling data from other documents or reports.
- Dispute/Finalize: The 15 day period in which the dispute resolution process may be invoked. If dispute resolution is not invoked, the product can be finalized.
- Dispute Meetings: In the event that the dispute/finalize step in the dispute resolution process does not result in a document satisfactory to all parties, the dispute will be resolved in higher level meetings (see Section 7.1.4).
- EA: Endangerment Assessment.
- ExpA: Exposure Assessment.
- Fed Register: Preparation and submittal of a notice to the Federal Register.
- Finalize: Notification given to the other Parties and the State that a document is final.
- FS: Feasibility Study.
- Internal Review: Review of a document by the government.
- Interim SAR: Interim Study Area Report.
- IRADD: Interim Response Action Decision Document

Media Report: Report describing the potential contamination of the air, water, biota, and buildings.

NTP: Notice to proceed with work.

PAS: Parties and State. Parties include Shell Oil Company and the United States (including Department of the Army, Environmental Protection Agency, Department of the Interior, and Agency for Toxic Substances and Disease Registry).

PAS Comment: PAS review of a document. Issues raised during this review period must be formally addressed.

PAS Review: PAS review of a document. Issues raised during this review may be informally addressed.

Ph1: Phase 1 activities for a particular task.

Ph2: Phase 2 activities for a particular task. Phase 2 activities are based on the results from Phase 1 activities.

PMO: Program Manager's Office for Rocky Mountain Arsenal Contamination Cleanup.

Resource: The following resources are used in the Microsoft Project 3.0 file RMAOK1 for the RI/FS Schedule: D - used for any activity with a significant date; DEAD - used for the activity which contains a deadline; and X - used for any activity with three or more predecessors.

Rewrite/Review: Steps taken at the conclusion of the dispute meeting phase of the dispute resolution process. Rewriting and review of the subject document takes place until the document reflects the final decision determined by the dispute resolution process.

RI: Remedial Investigation.

RIFS#: RI/FS task number designation under new contract.

Risk Char: Risk Characterization.

ROD: Record of Decision.

SAR: Study Area Report.

TED#: Task number designation for Technology Division/USATHAMA effort.

WHITE: Final document.

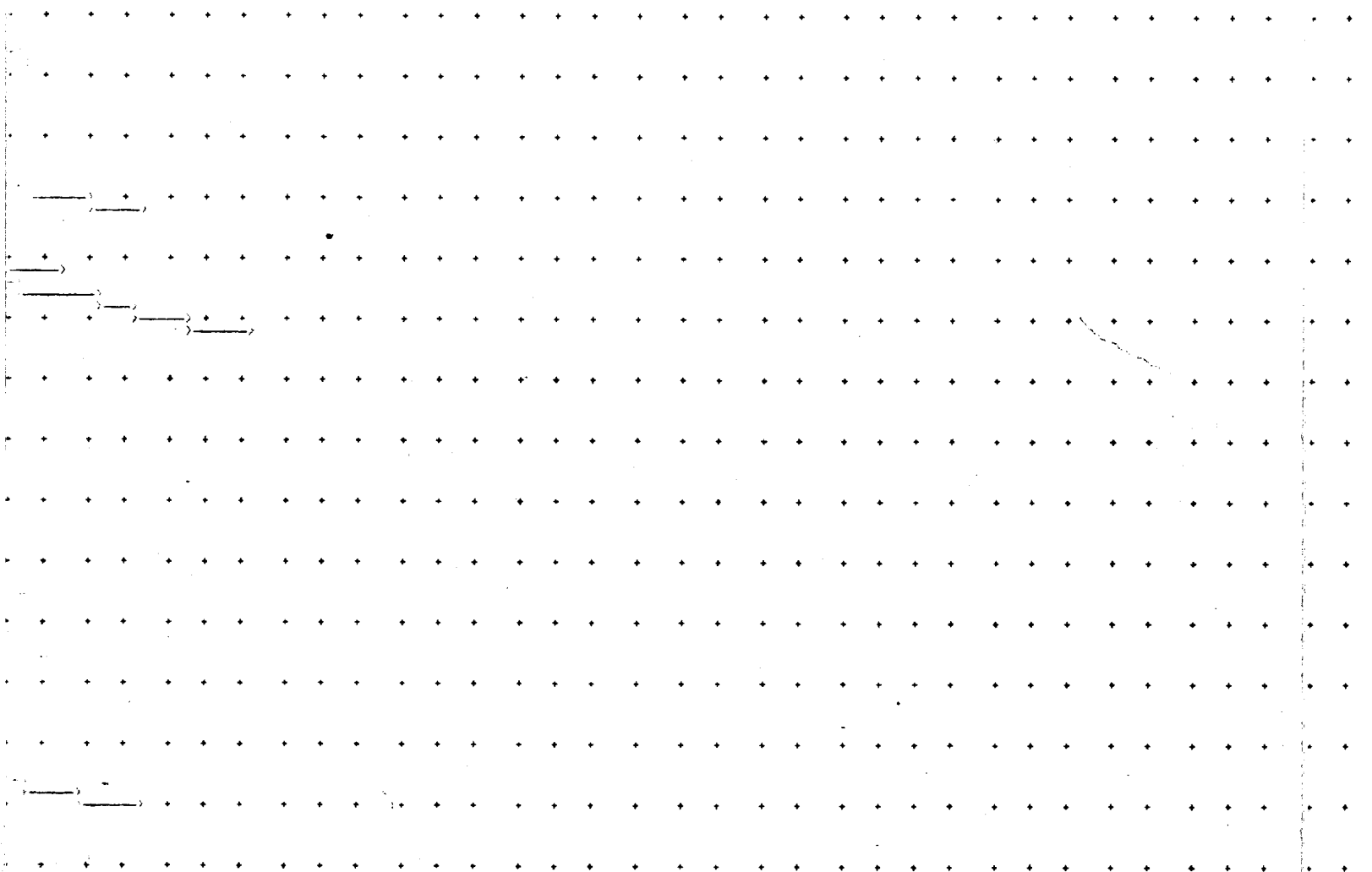
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00-00 Ebasco/ESE/Architects Hist

00-00 ** TECHNICAL PROGRA
00-01 P
00-02 Draft Final Pro
00-03 Dispute
00-04 Approval/Disput
00-05 Rewrit
00-06 Finalize Pro

00-00 **** 01 SOILS PRO

01-00 ** SECTION 36 (PHI
01-01 Lead Response LU
01-02
01-03 Mob
01-04 Field
01-05 Laboratory
01-06 Data Co
01-07 WHITE Ph2
01-08 P

02-00 ** SOUTH PLANTS (PHI
02-01 Internal Review of C
02-02 PAS Comments CB
02-03 Prepare
02-04 Field
02-05 Lab
02-06 Data Co
02-07 WHITE Ph2
02-08 P

02-00 ** SOUTH PLANTS REGIONAL
02-01 Shell Spills
02-02 PA
02-03 Prepare
02-04 SPR Mob
02-05 SPR Field
02-06 SPR Lab
02-07 SPR Data Co
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02-09 P

24-00 ** ARMY SPILL
24-01
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24-07 Mob
24-08 Field
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24-10 Data Co
24-11 Army Sp
24-12 P

11-00 ** HYDRAZINE AREA (PHI
11-01 Data Co
11-02 Internal Review of
11-03 PAS Comments CB
11-04 Prepare
11-05
11-06 Mob
11-07 Field
11-08 Lab
11-09 Data Co
11-10 WHITE Ph2
11-11 P

06-00 ** BASINS
06-01 Internal Revi
06-02 PAS Comments CB

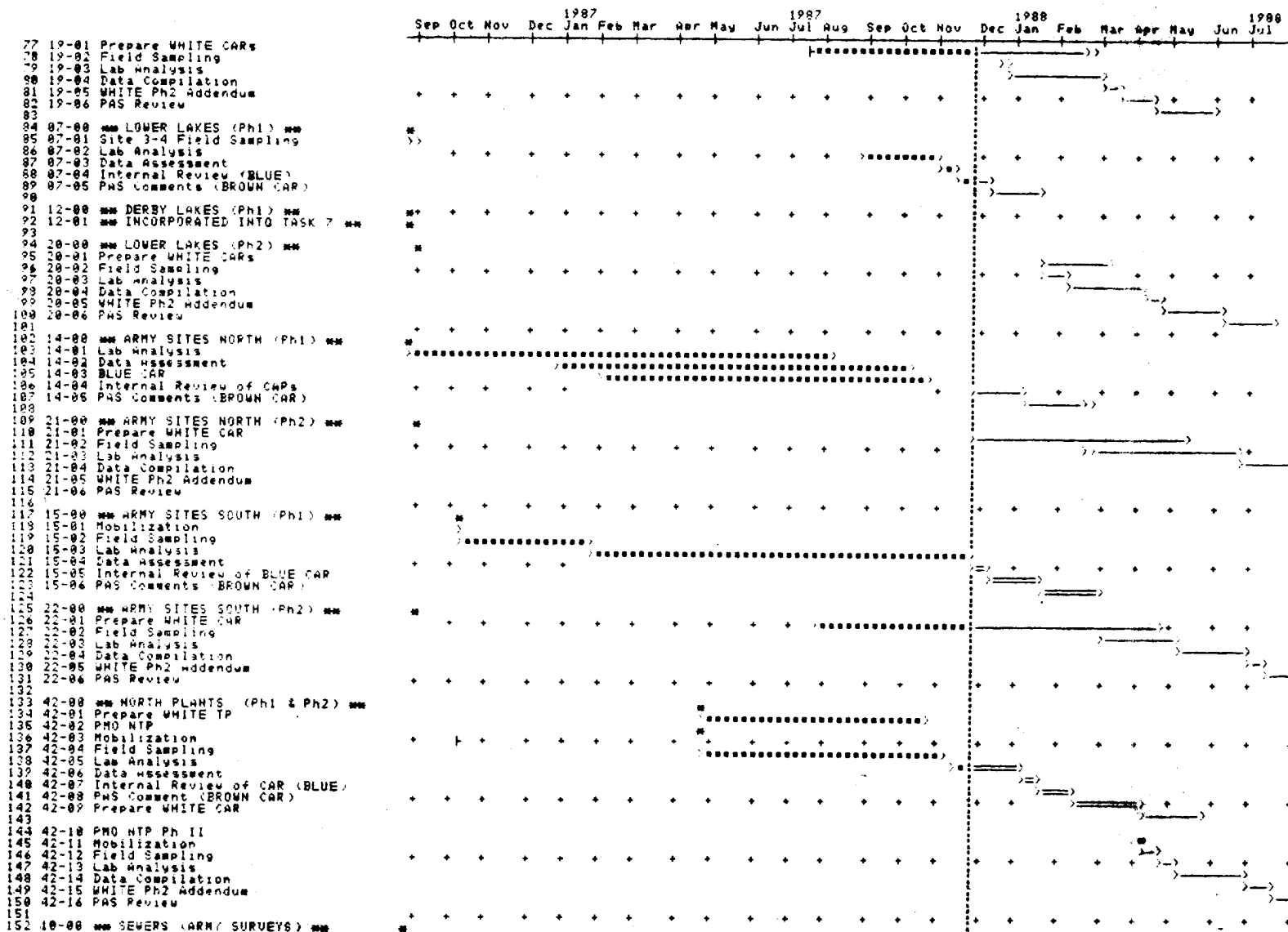
19-00 ** BASINS

PH RI/FS
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Finalize Program Plan 9
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07-00 ~~see~~ LOWER LAK
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42-08 PAS Agreement ()
42-08 Prepare

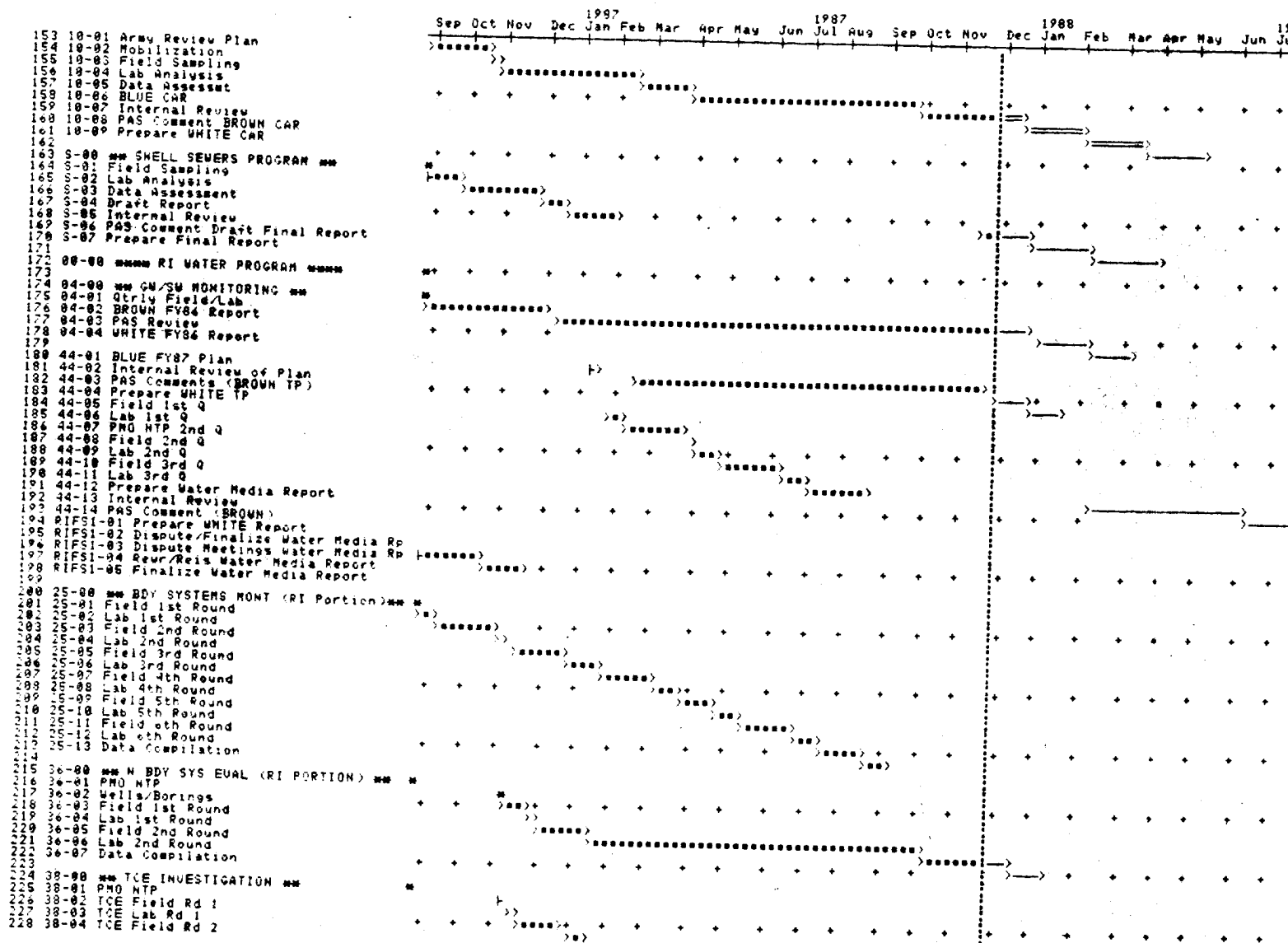
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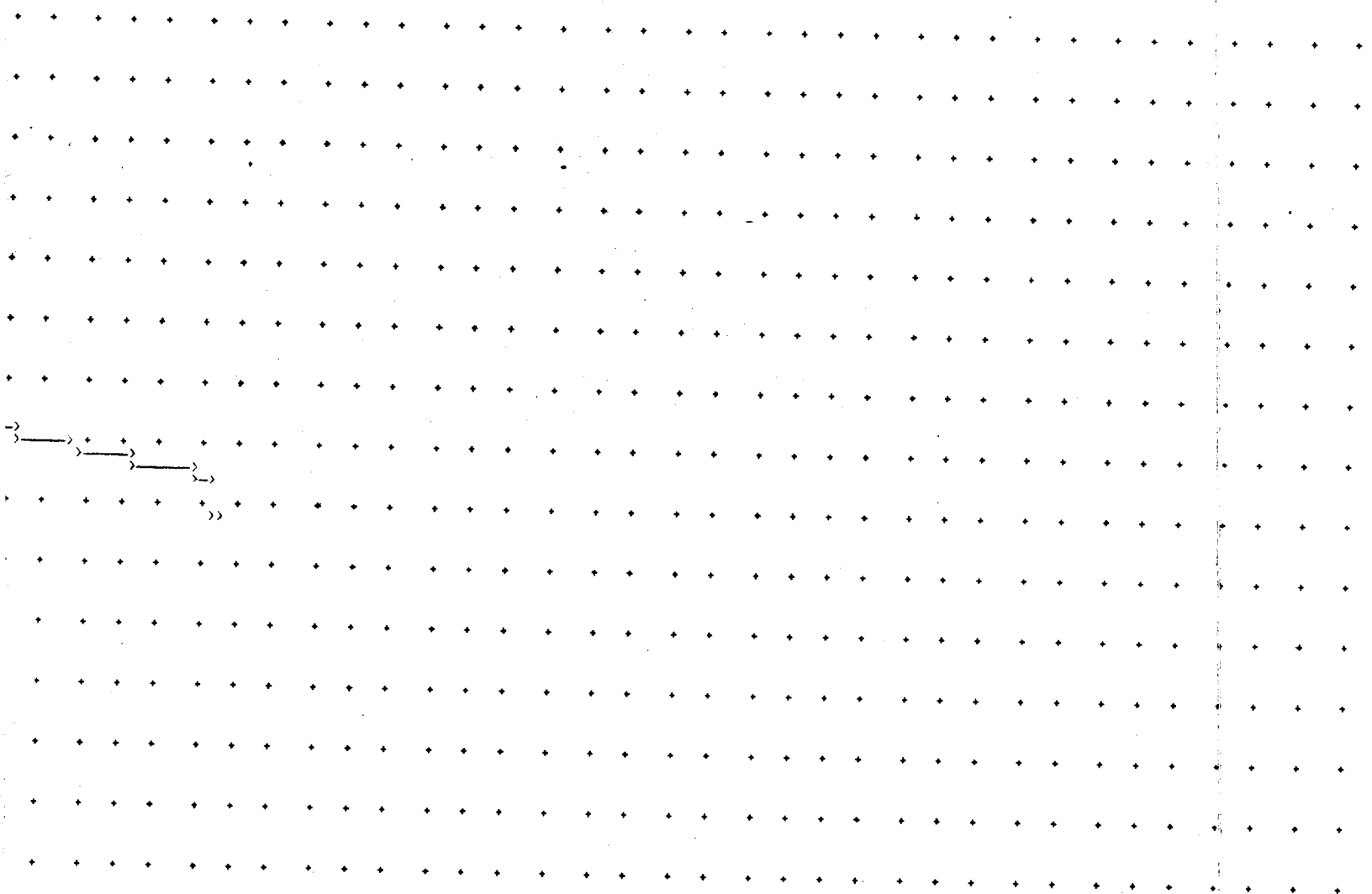


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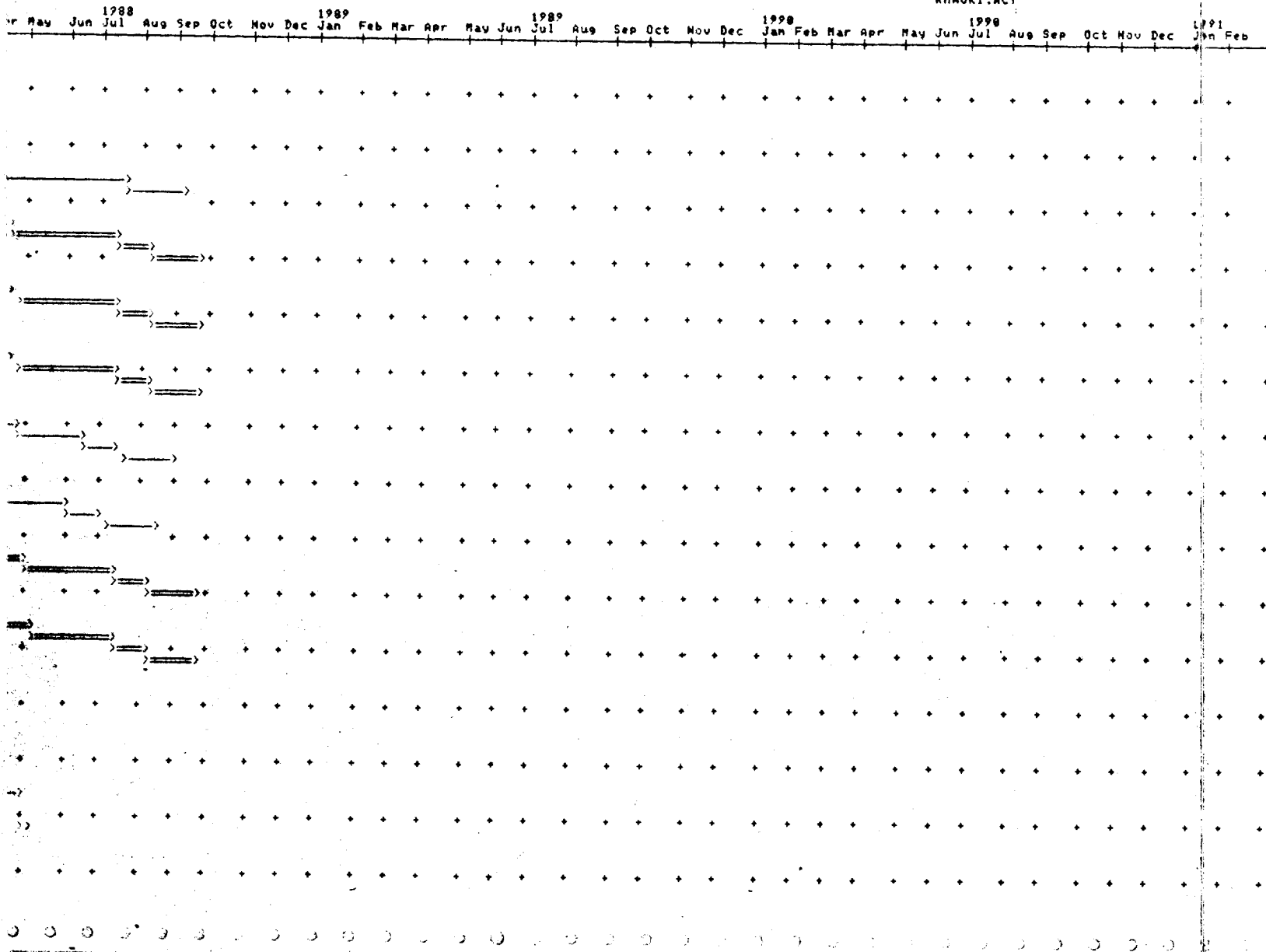
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230 38-06 Data Assessment																						
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236 23-00 *** CU/SW/SO INTEGRATION PLANNING***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
237 RI/FCS Committee Meeting																						
238 23-02 Internal Review of Plan BLUE																						
239 23-03 PAS Comment (BROWN TP)																						
240 23-04 Prepare WHITE TP																						
241 23-05 Prepare Ph I Interim Soils Report																						
242 23-06 PAS Review																						
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244 47-20 *** INTERIM EASTERN SAR ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
245 47-21 Data Integration																						
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247 47-23 Interim SAR Preparation (BLUE)																						
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250 47-30 *** INTERIM CENTRAL SAR ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
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252 47-32 Contamination Assessment																						
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256 47-40 *** INTERIM NORTH-CENTRAL SAR ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
257 47-41 Data Integration																						
258 47-42 Contamination Assessment																						
259 47-43 Interim SAR Preparation (BLUE)																						
260 47-44 Internal Review																						
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263 48-11 Data Integration																						
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268 48-20 *** INTERIM SOUTHERN SAR ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
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288 18-00 *** AIR MONITORING ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
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296 18-08 Dispute/Finalize Media Report																						
297 18-09 Dispute Meetings Media Report																						
298 18-10 Rewrite/Reissue Media Report																						
299 18-11 Finalize Air Media Report																						
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301 00-00 *** RI BIOTA PROGRAM ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
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303 07-00 *** BIOTA (Army) ***	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
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23-00 ** GW SOIL INTEGRATION PLANNING **
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23-03 Interim SAR Preparation (BLUE)
23-04 Prepare WHITE TP
23-05 Prepare Ph I Interim Soils Report
23-06 PAS Review
47-20 ** INTERIM EASTERN SAR **
47-21 Data Integration
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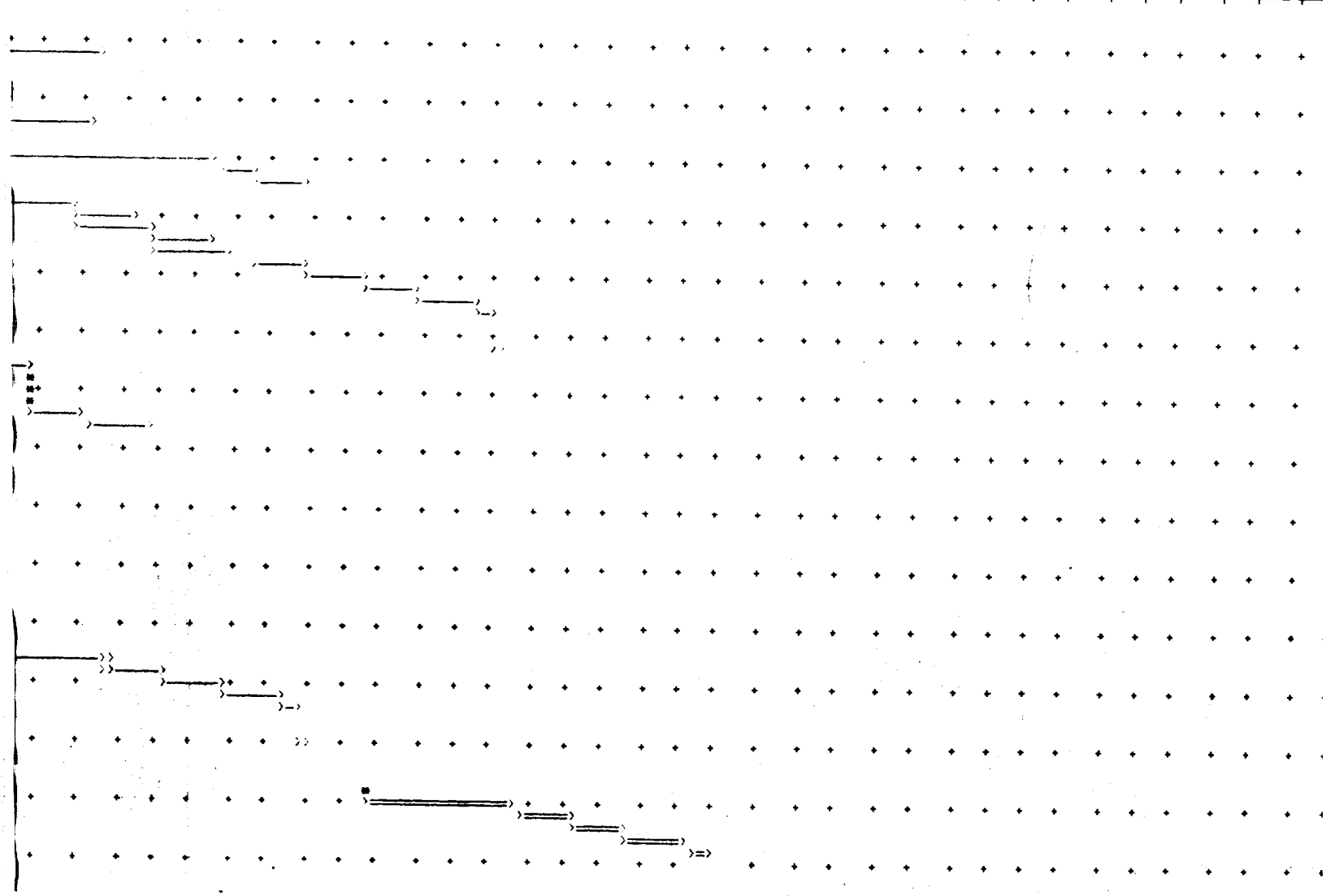

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396	09-13 Process 1987 Samples																								
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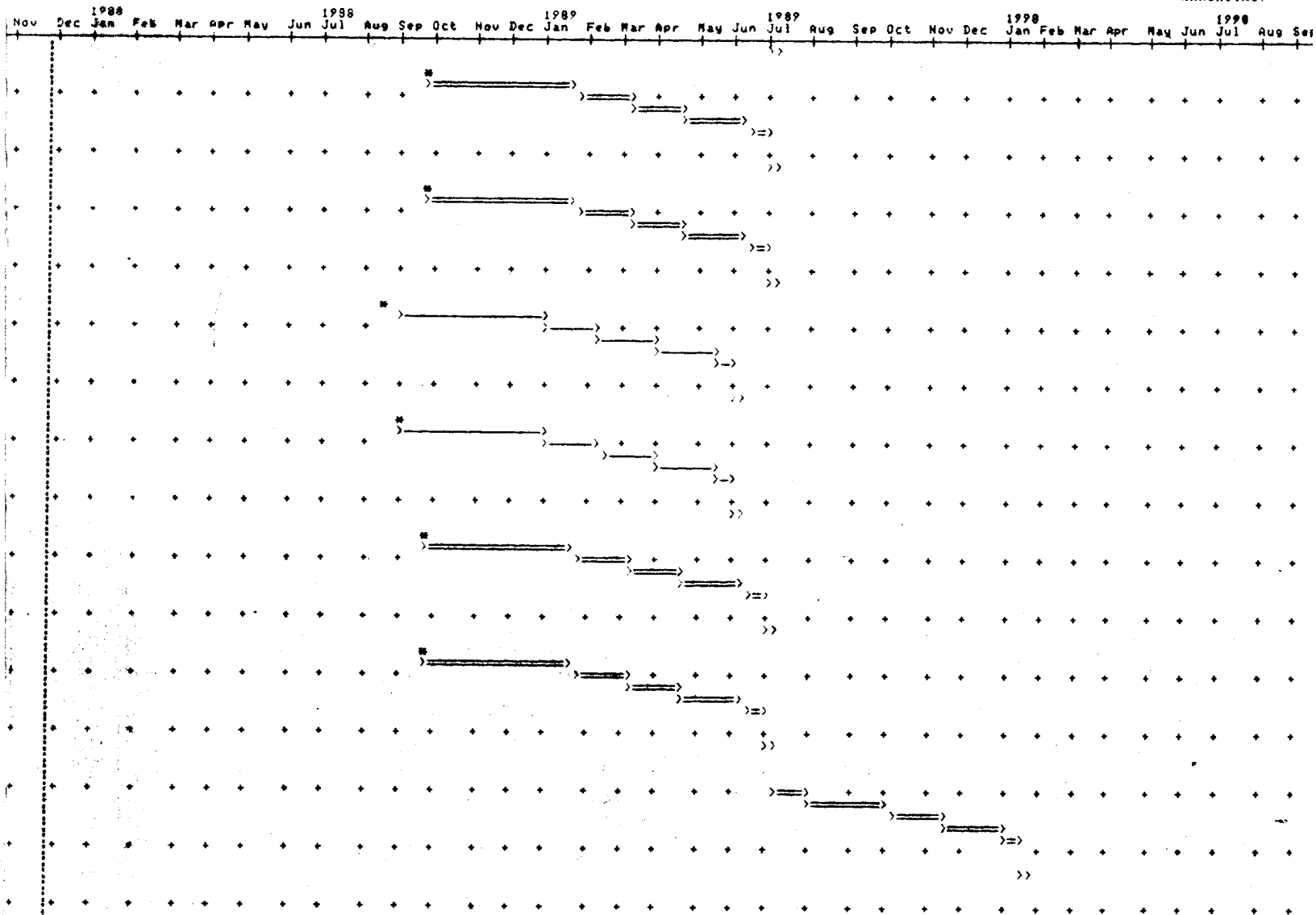
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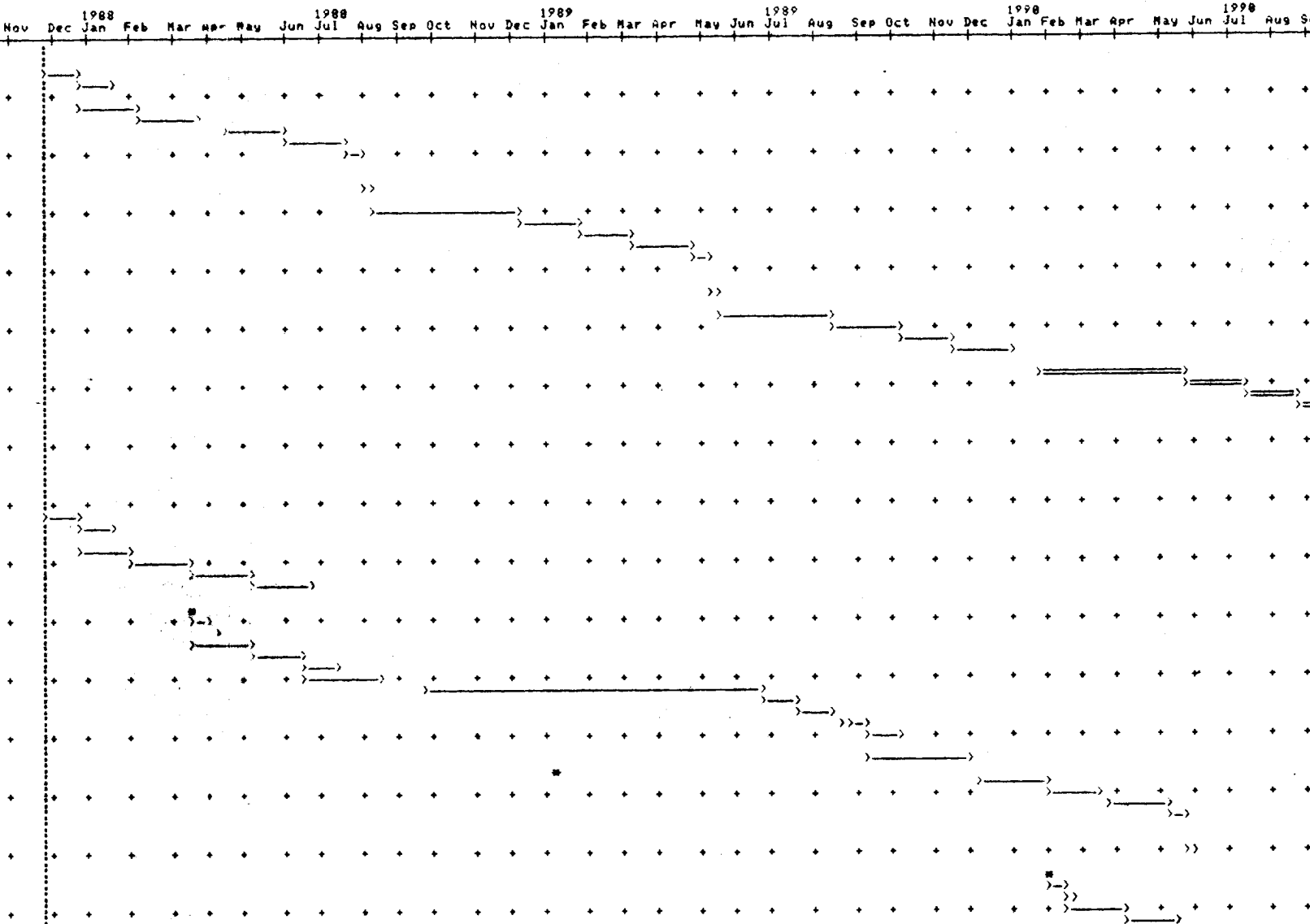
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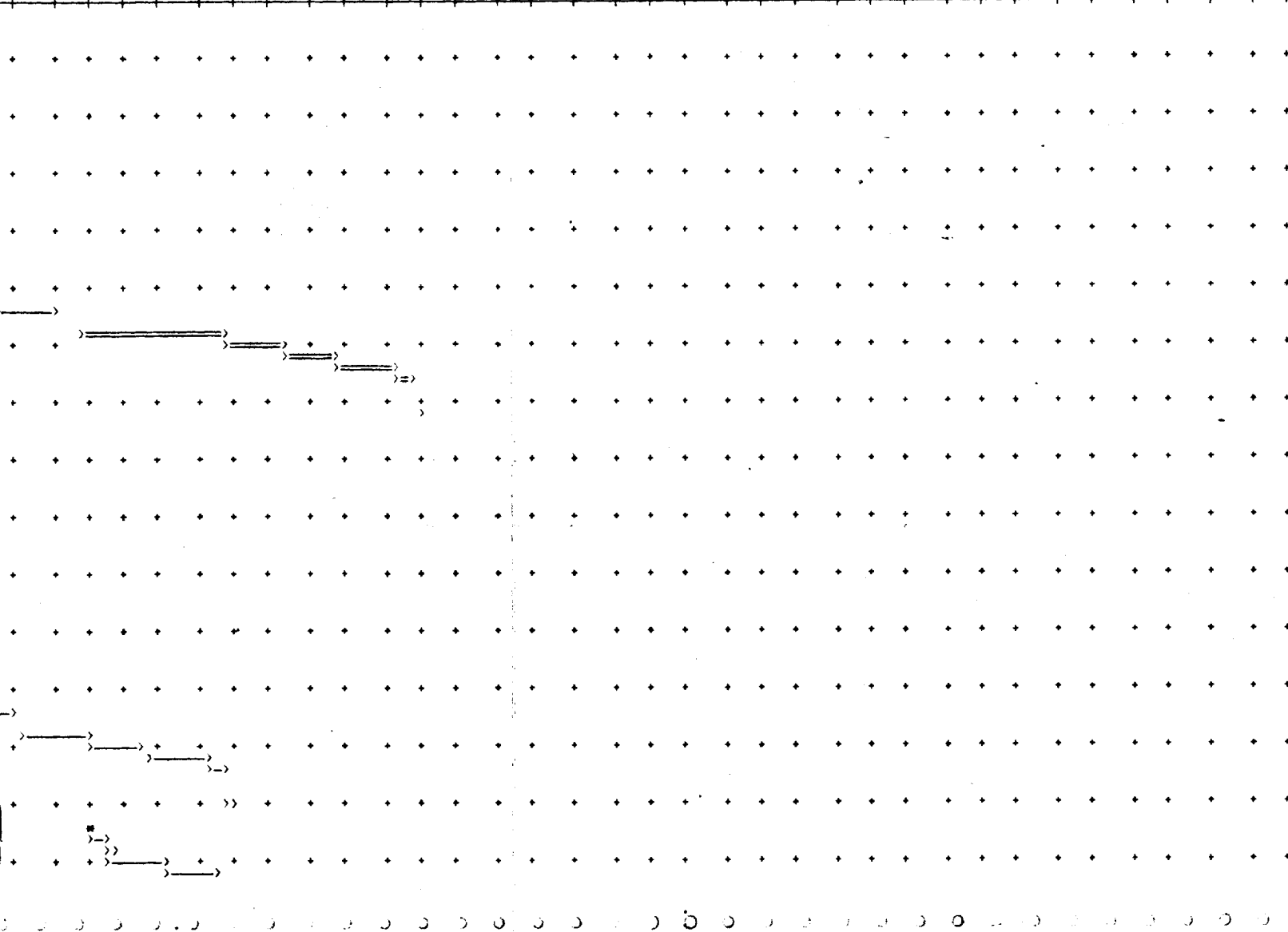
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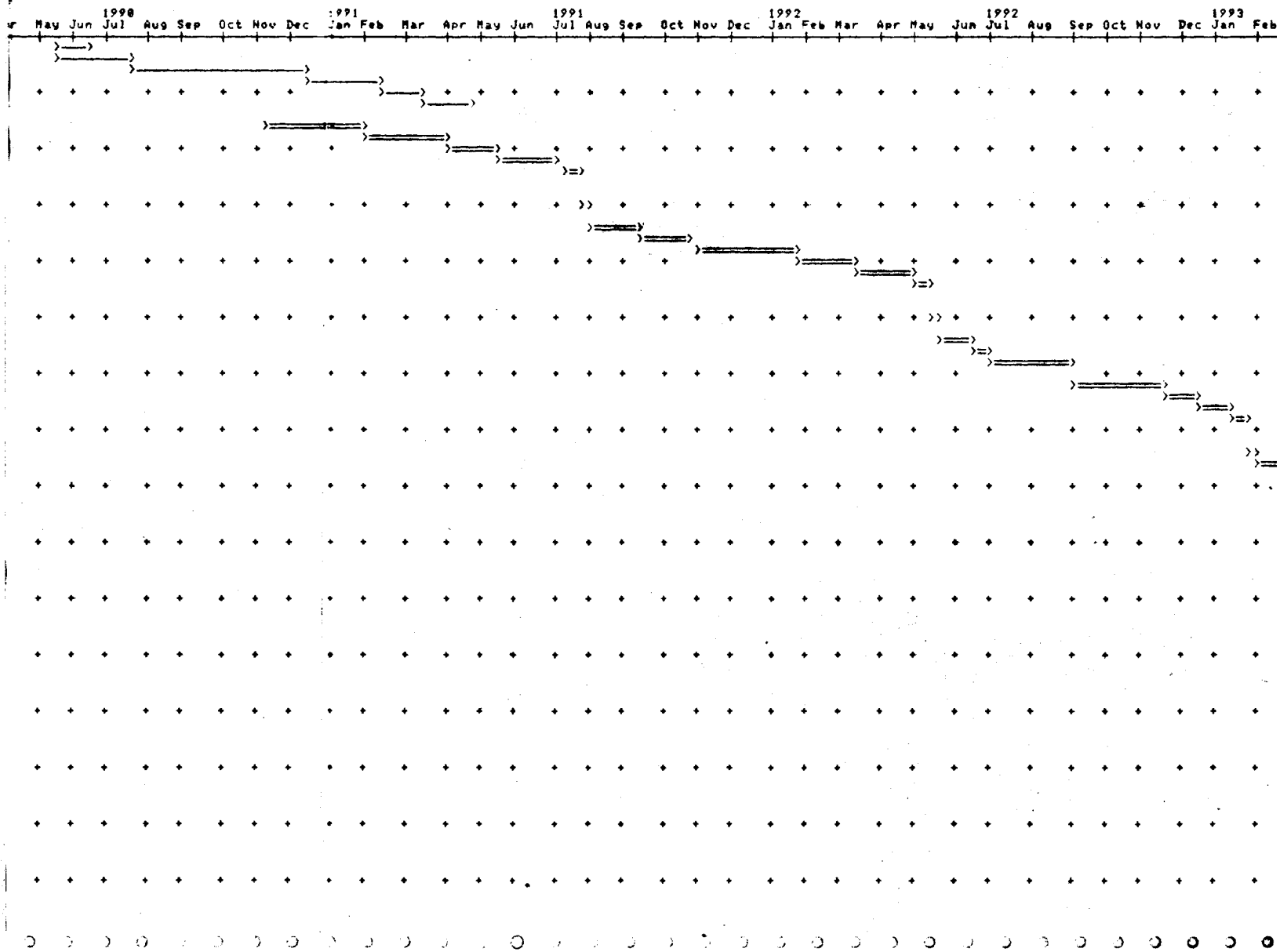
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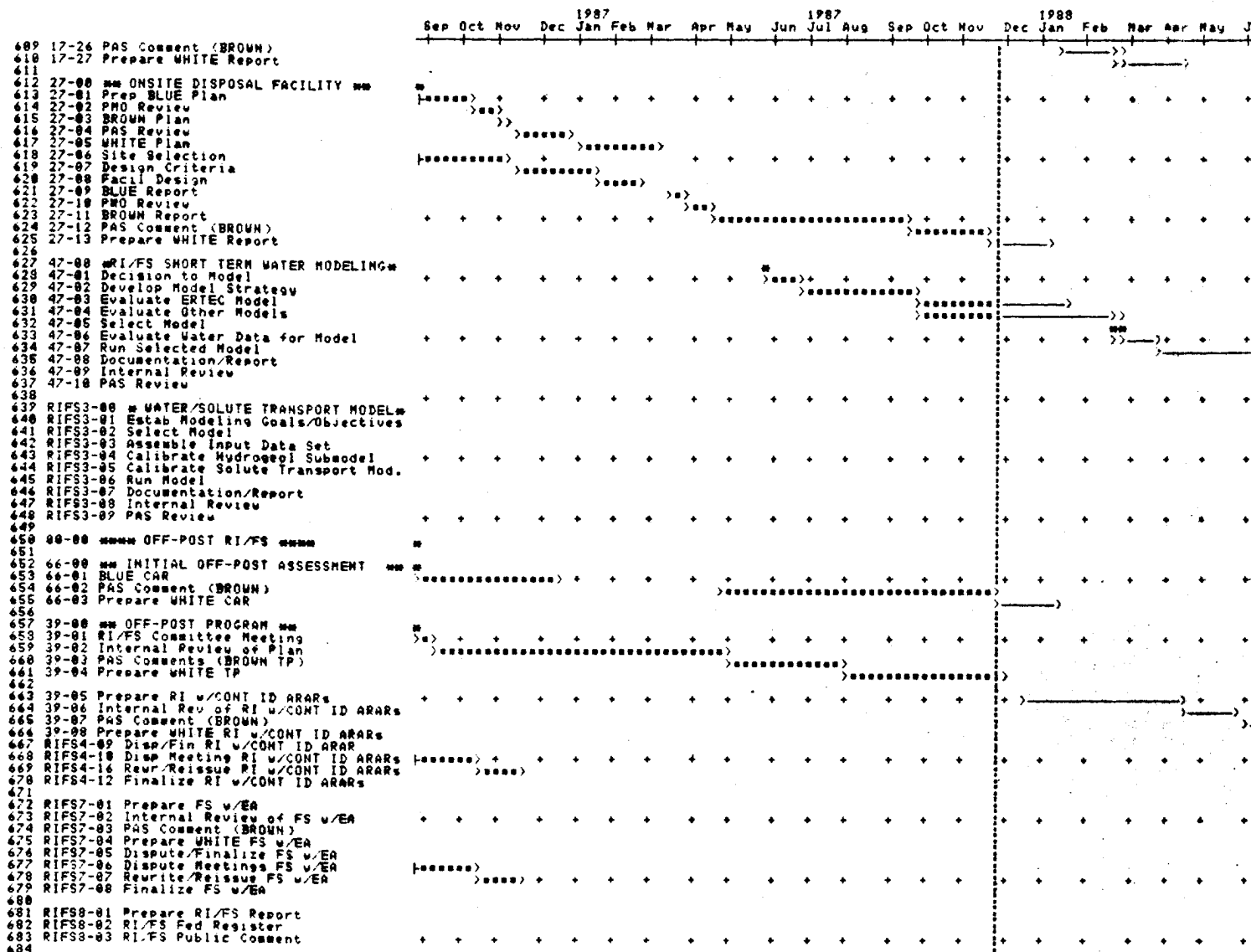
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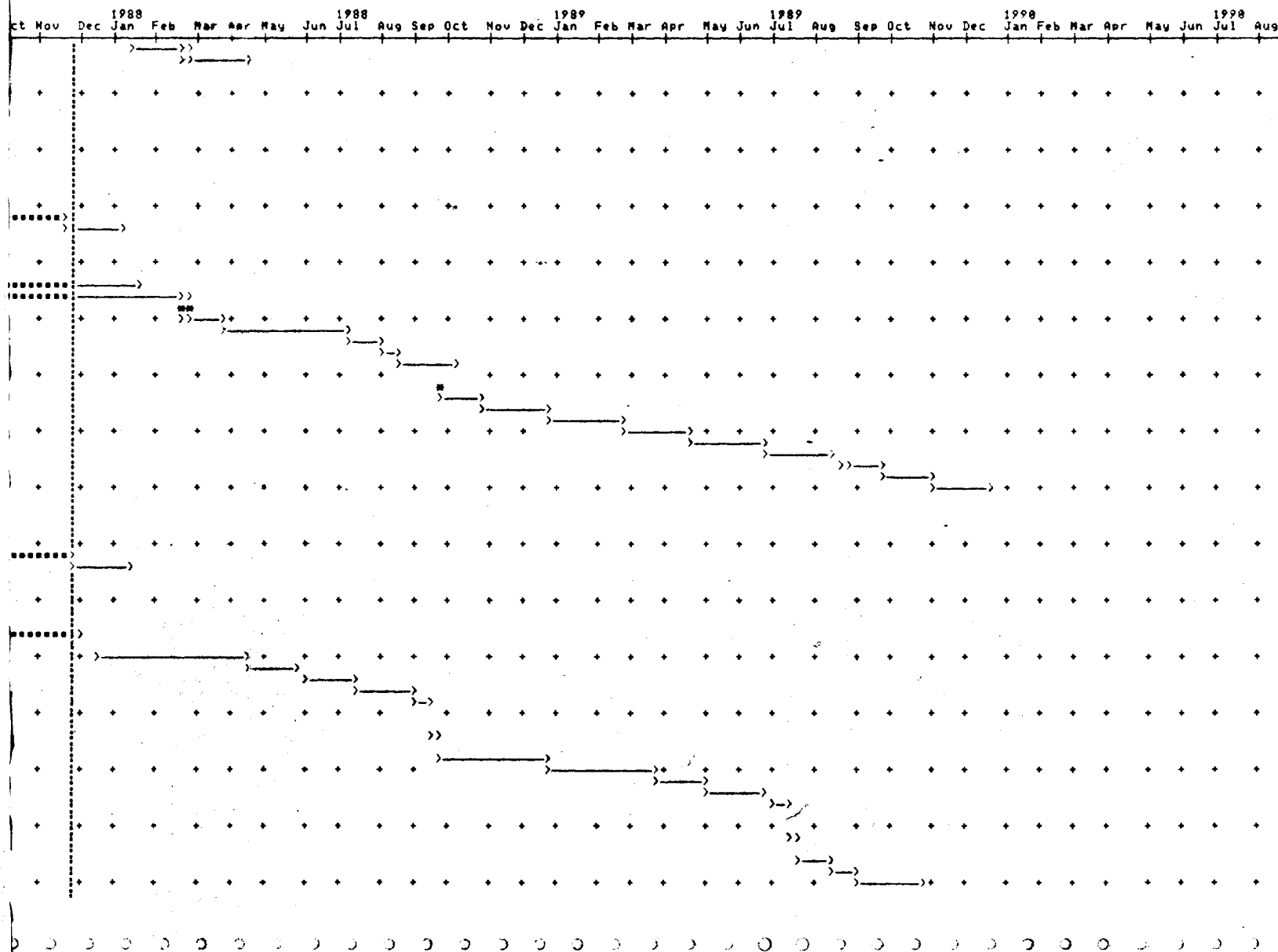
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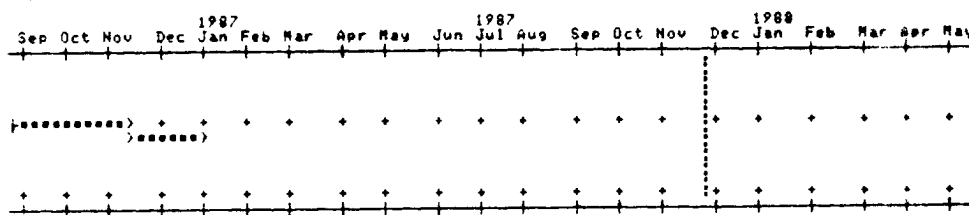
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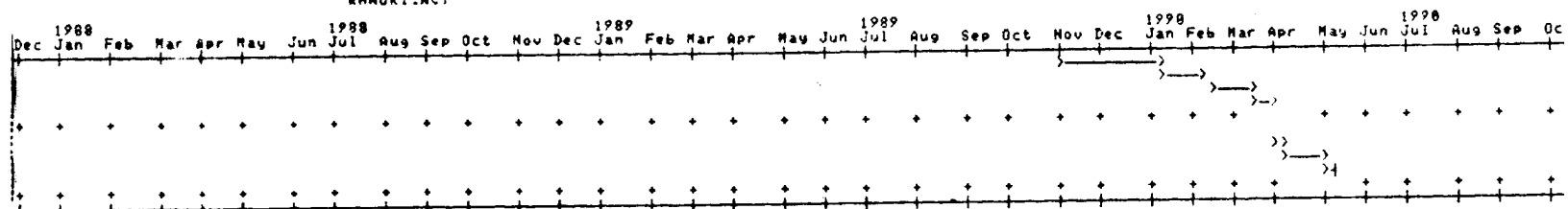
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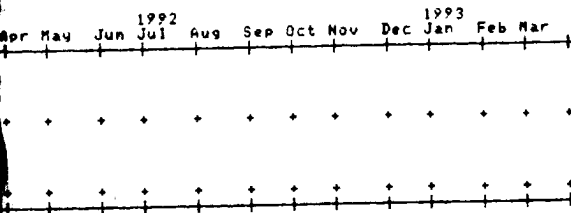


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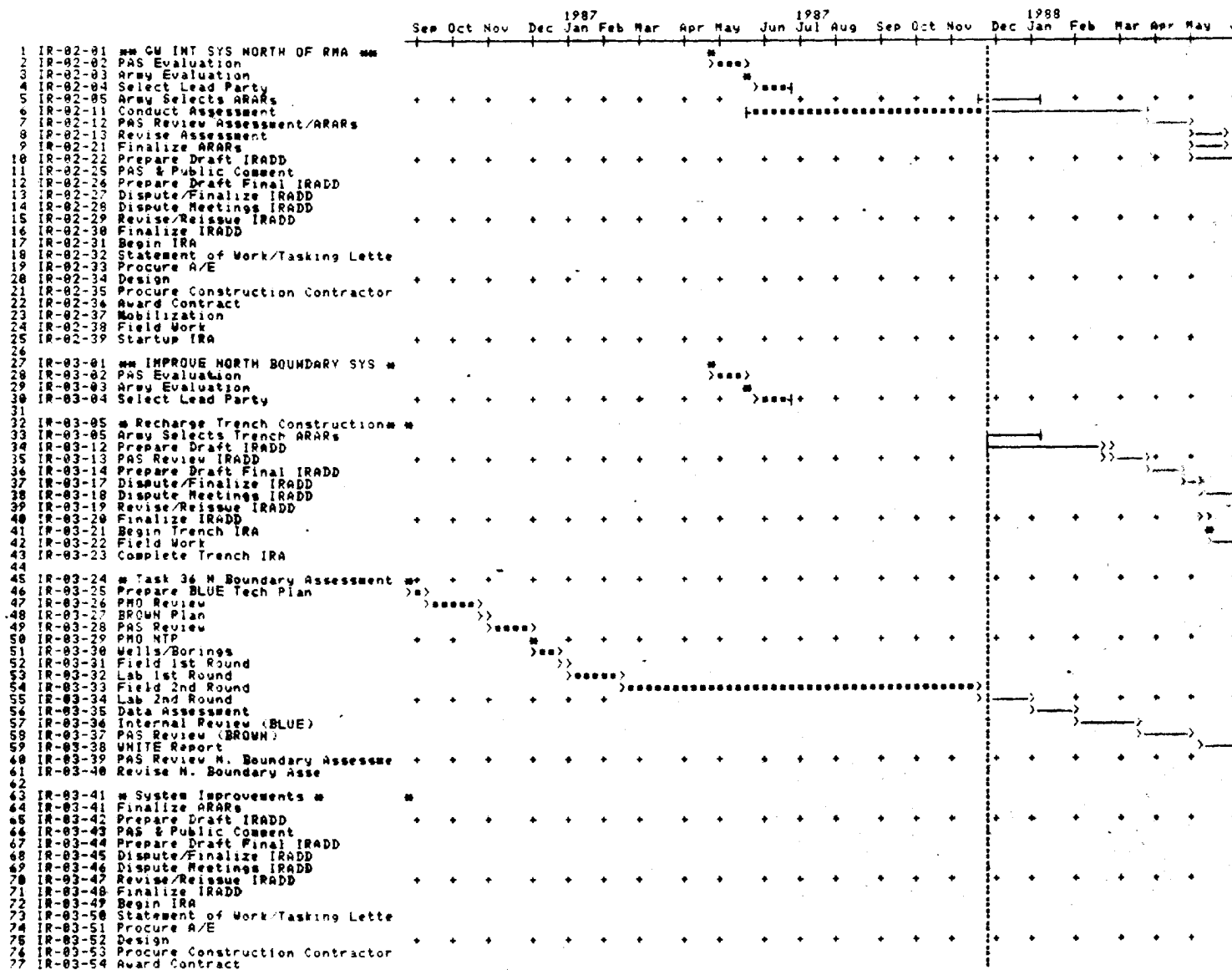
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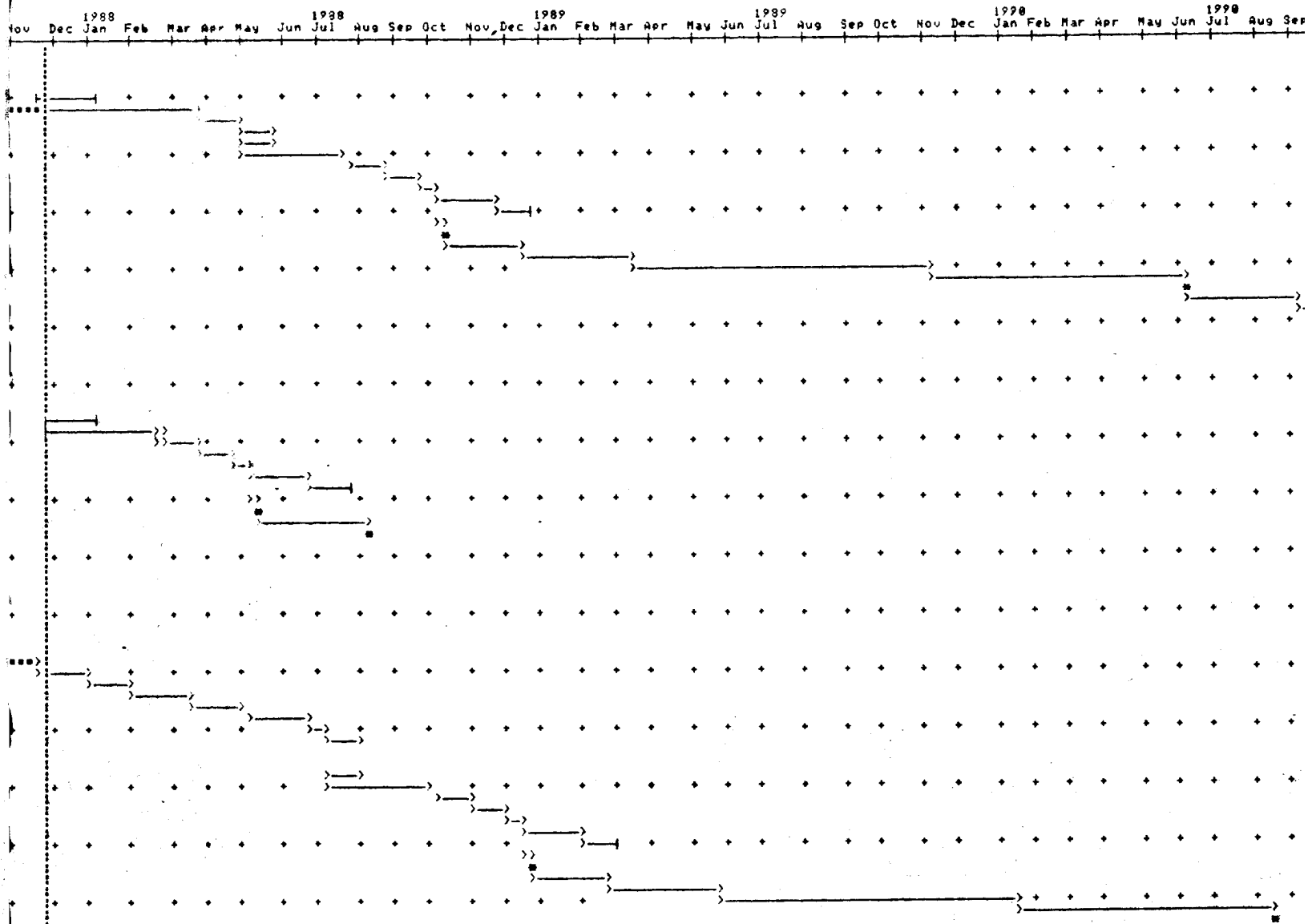
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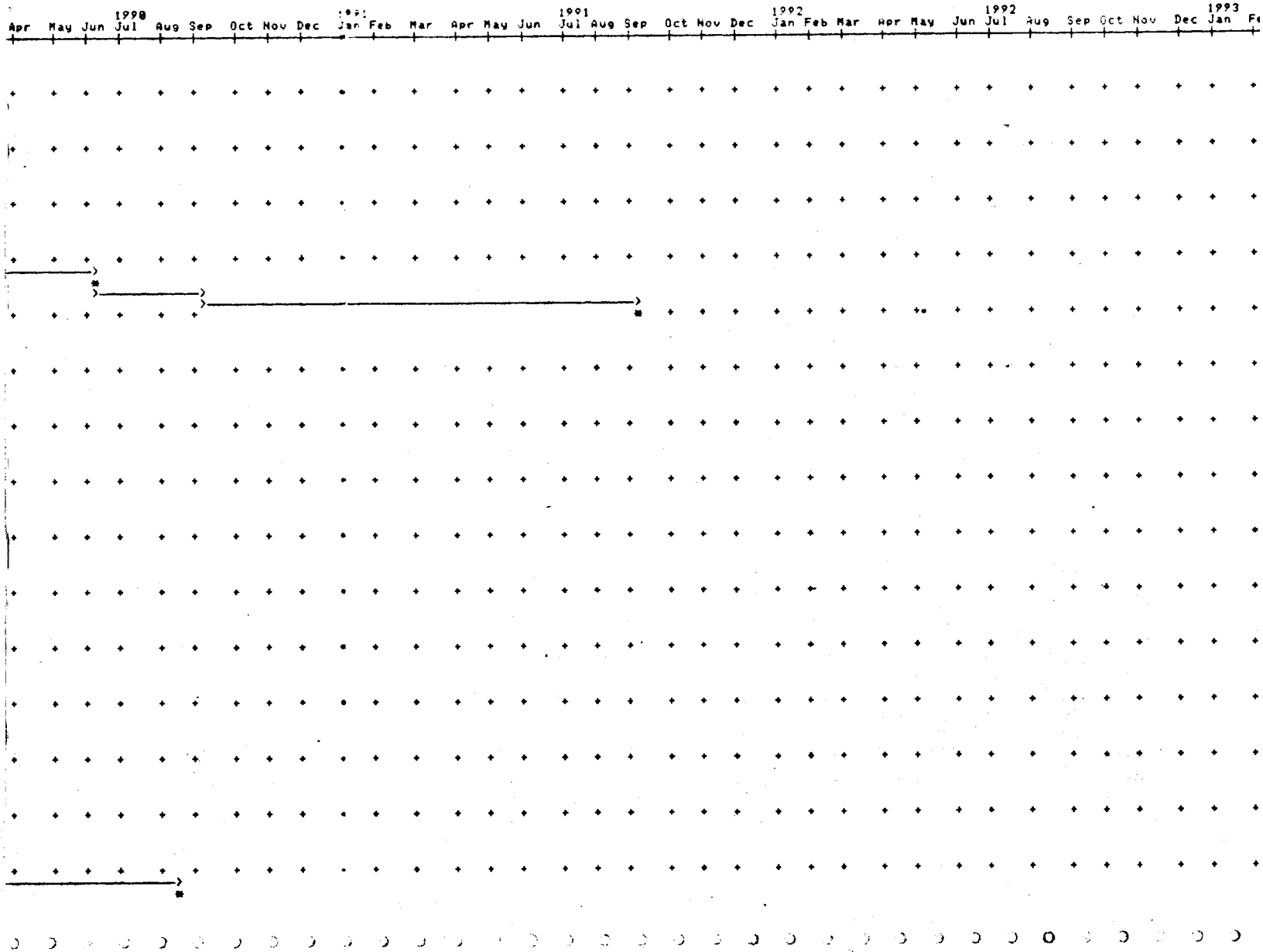
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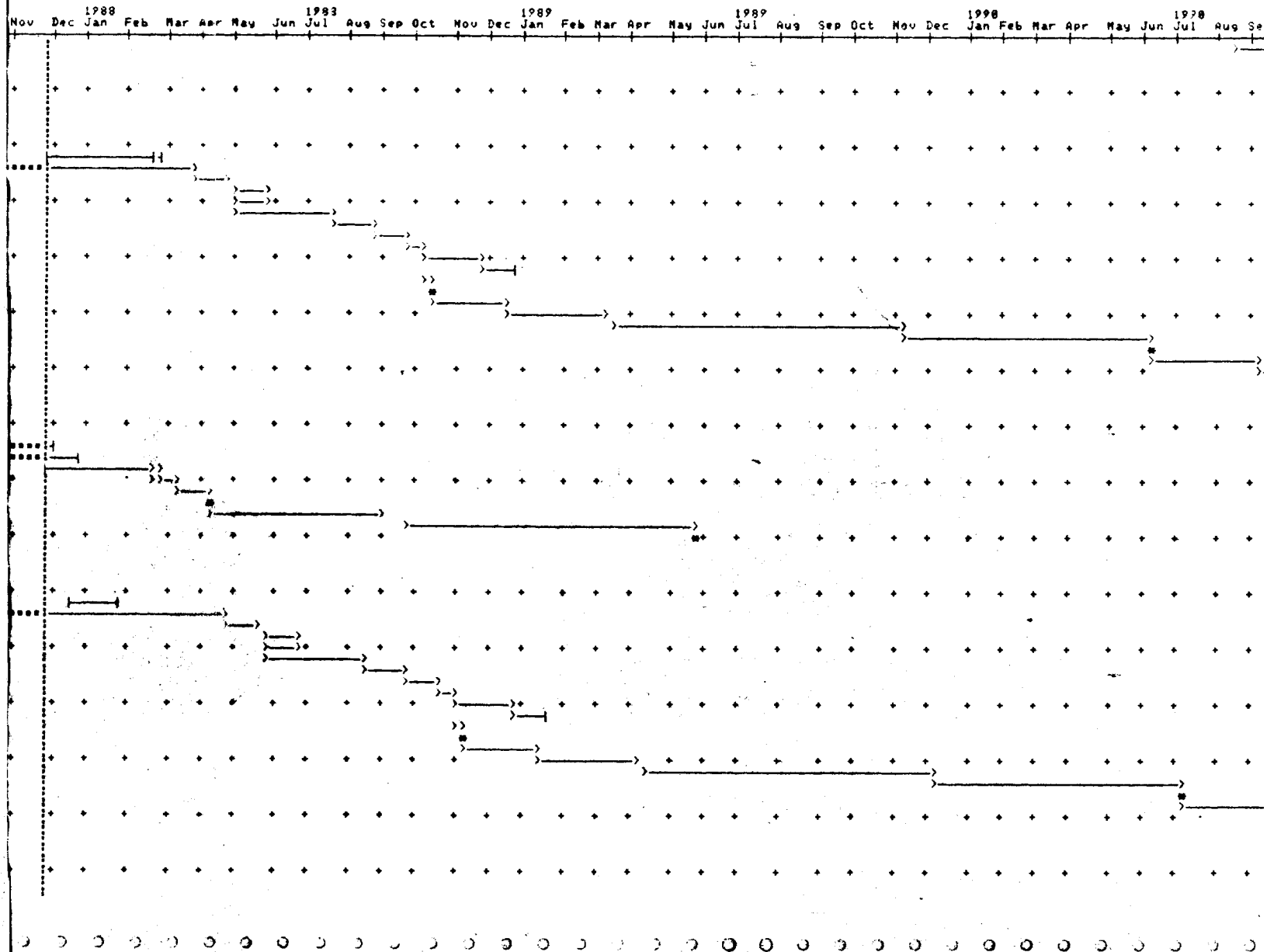
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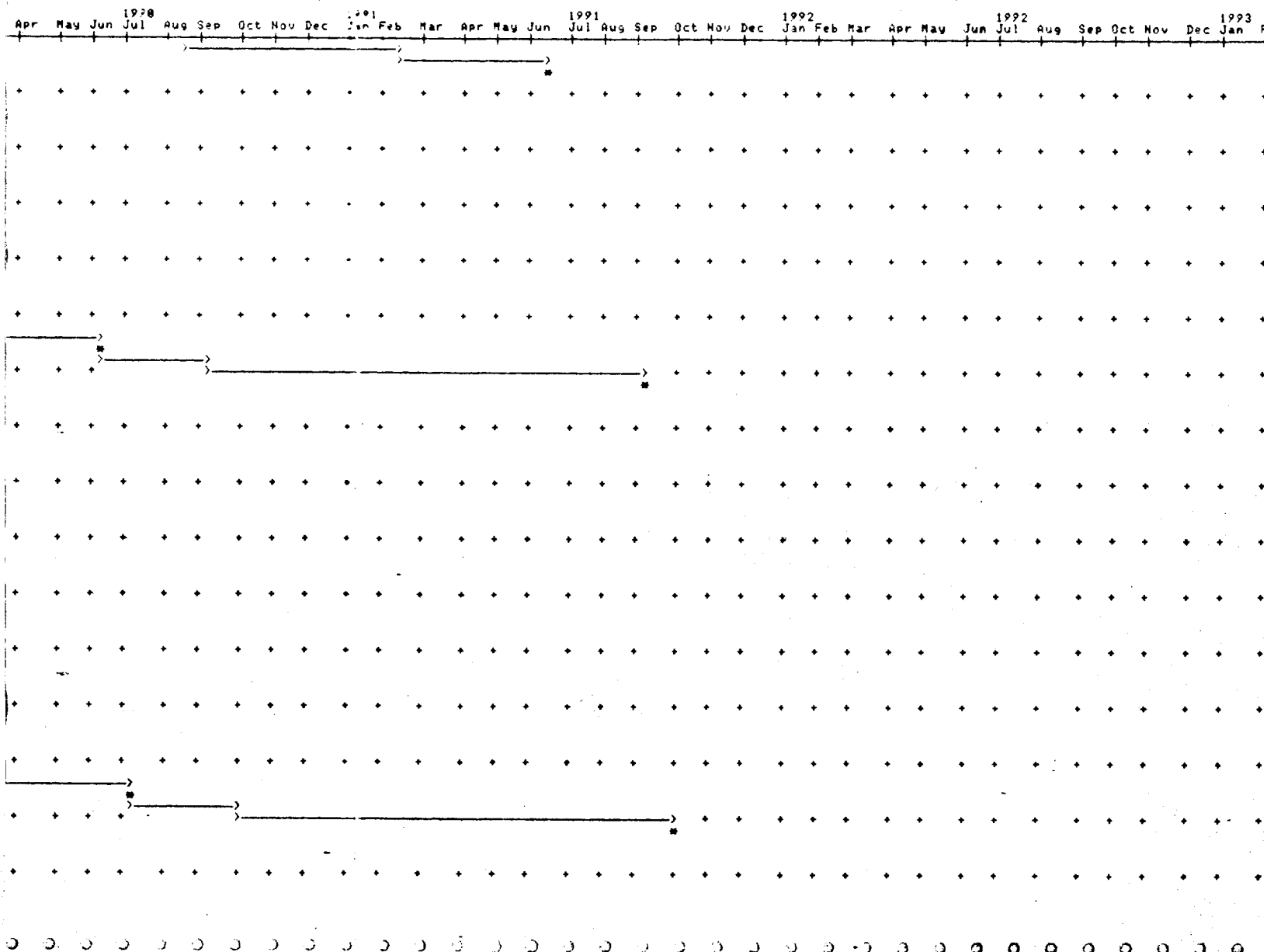
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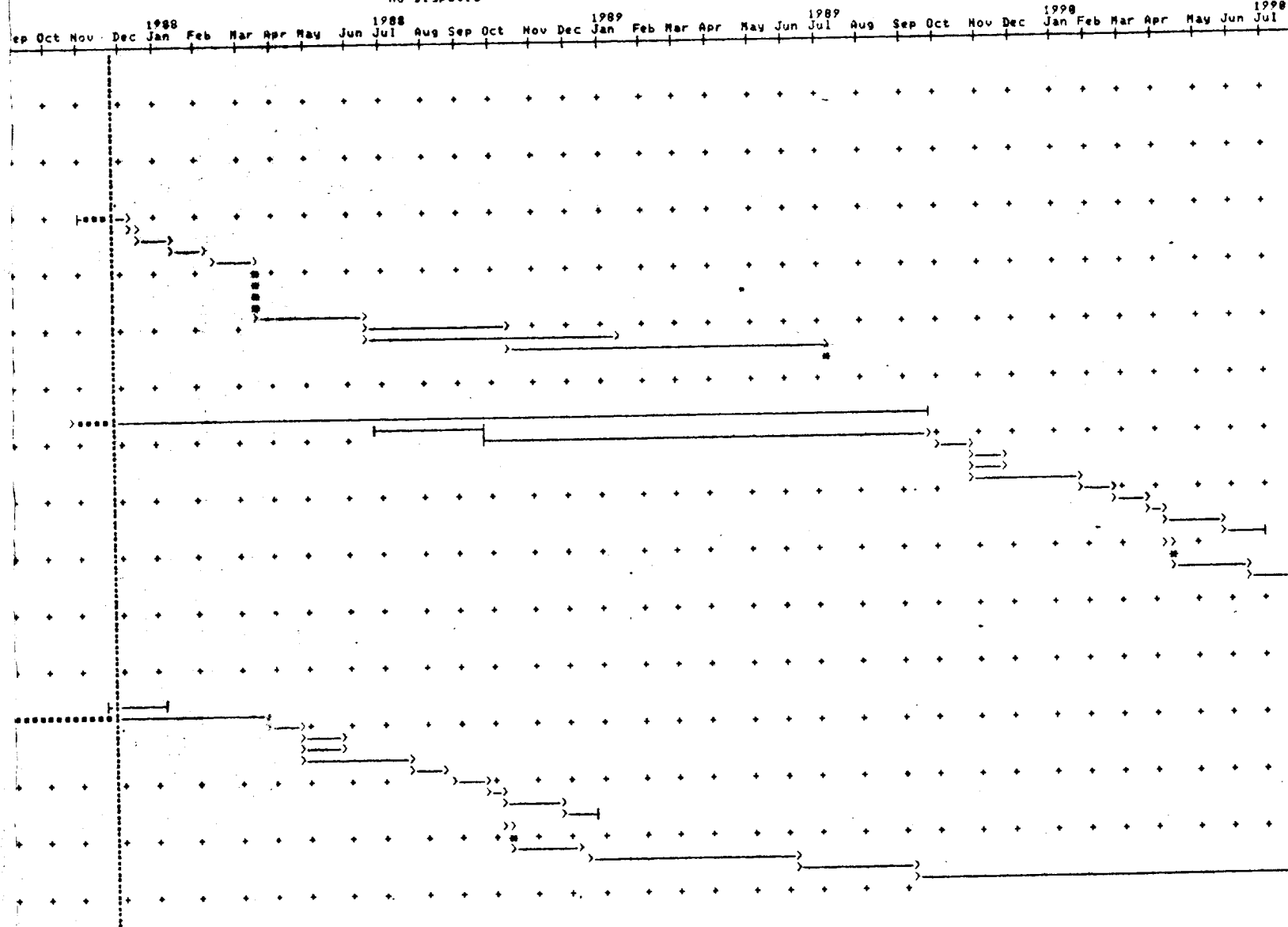
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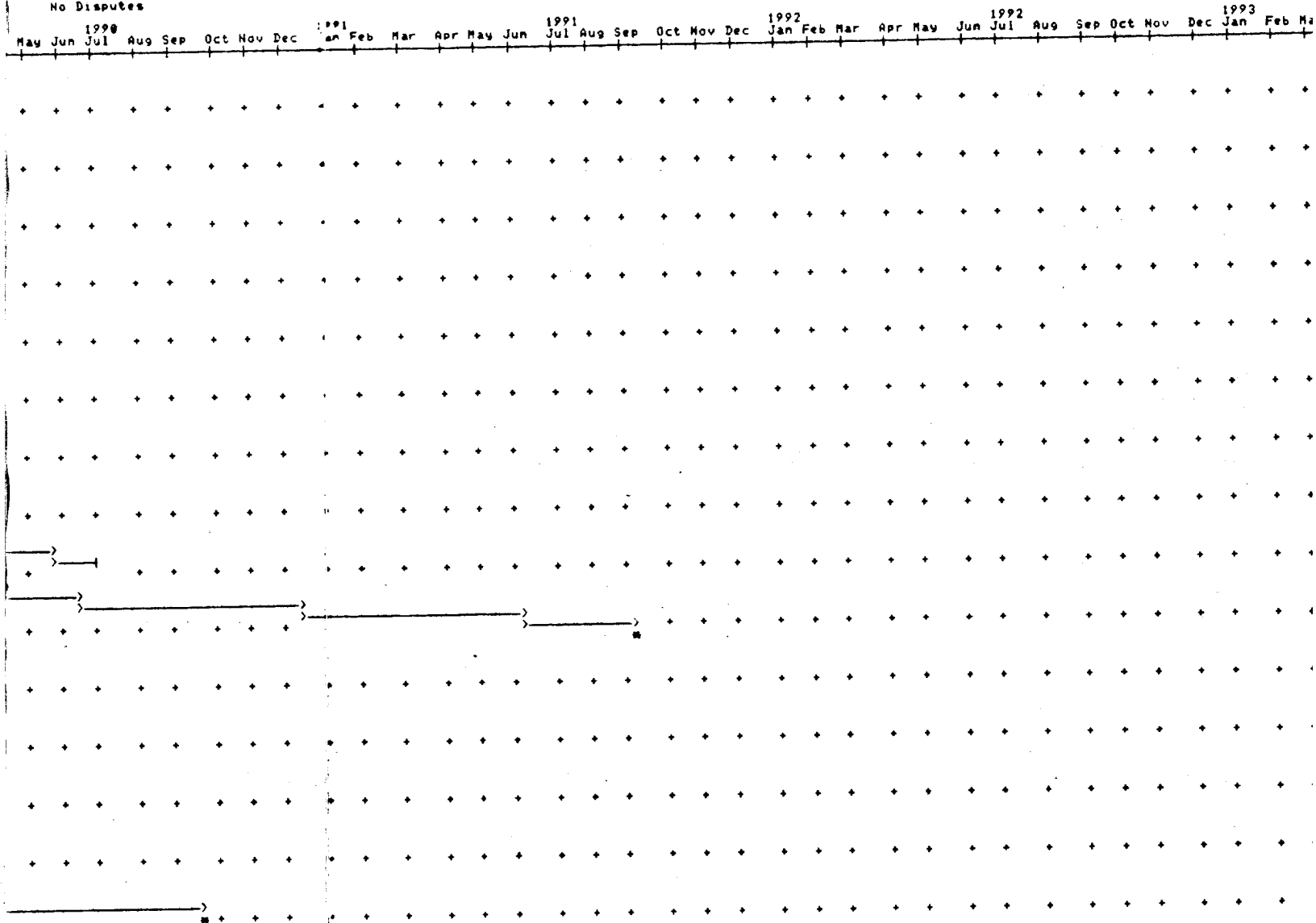
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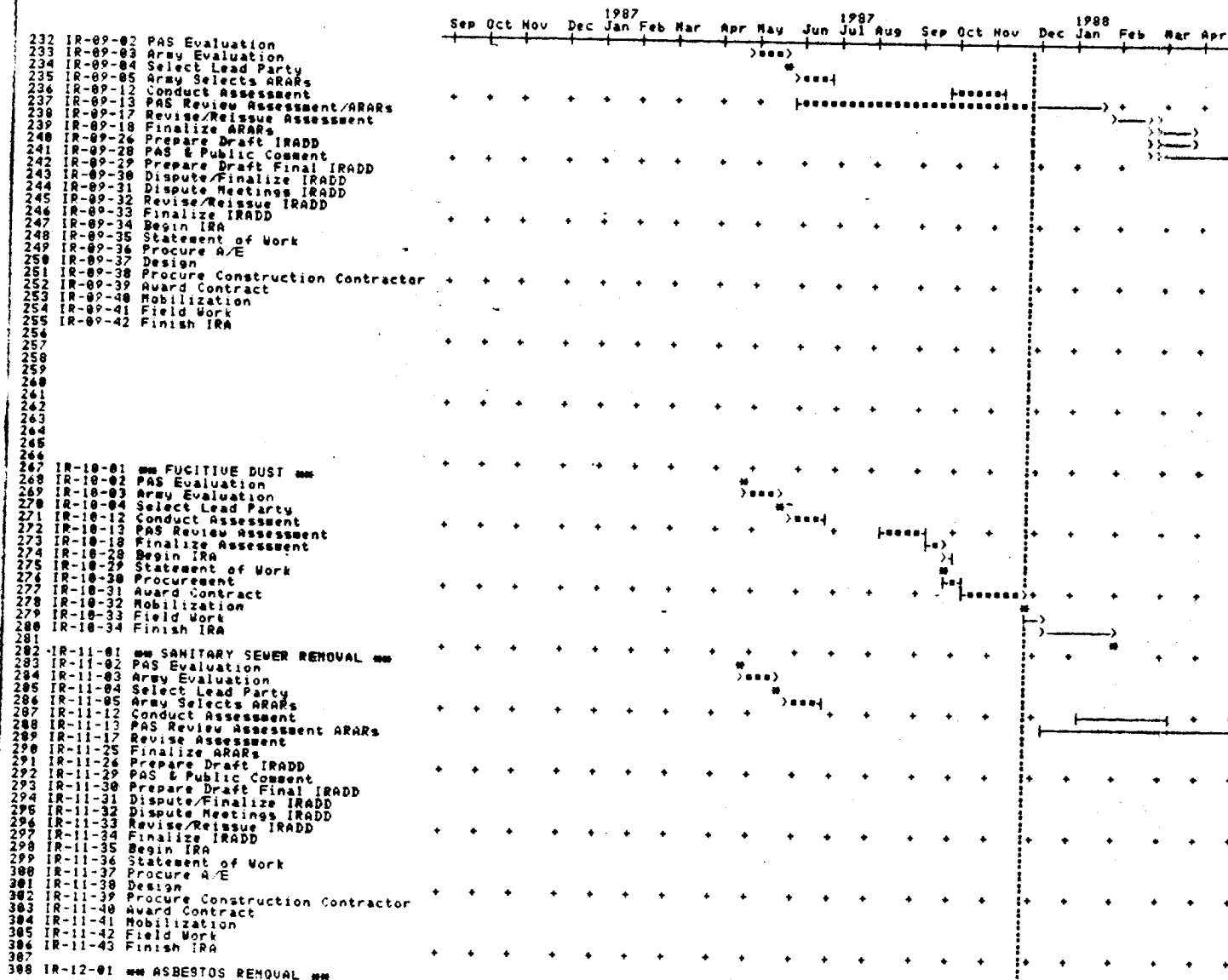
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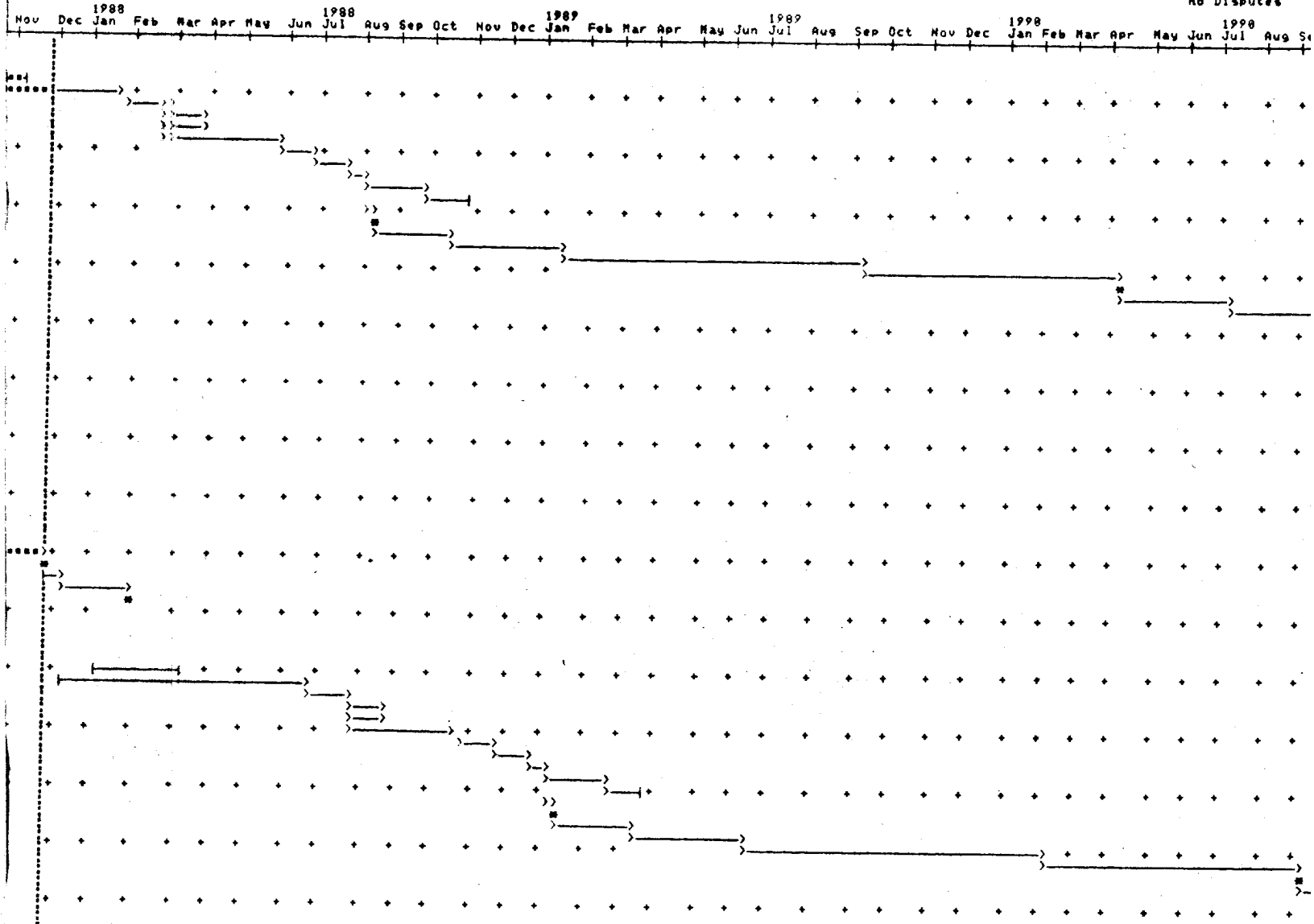
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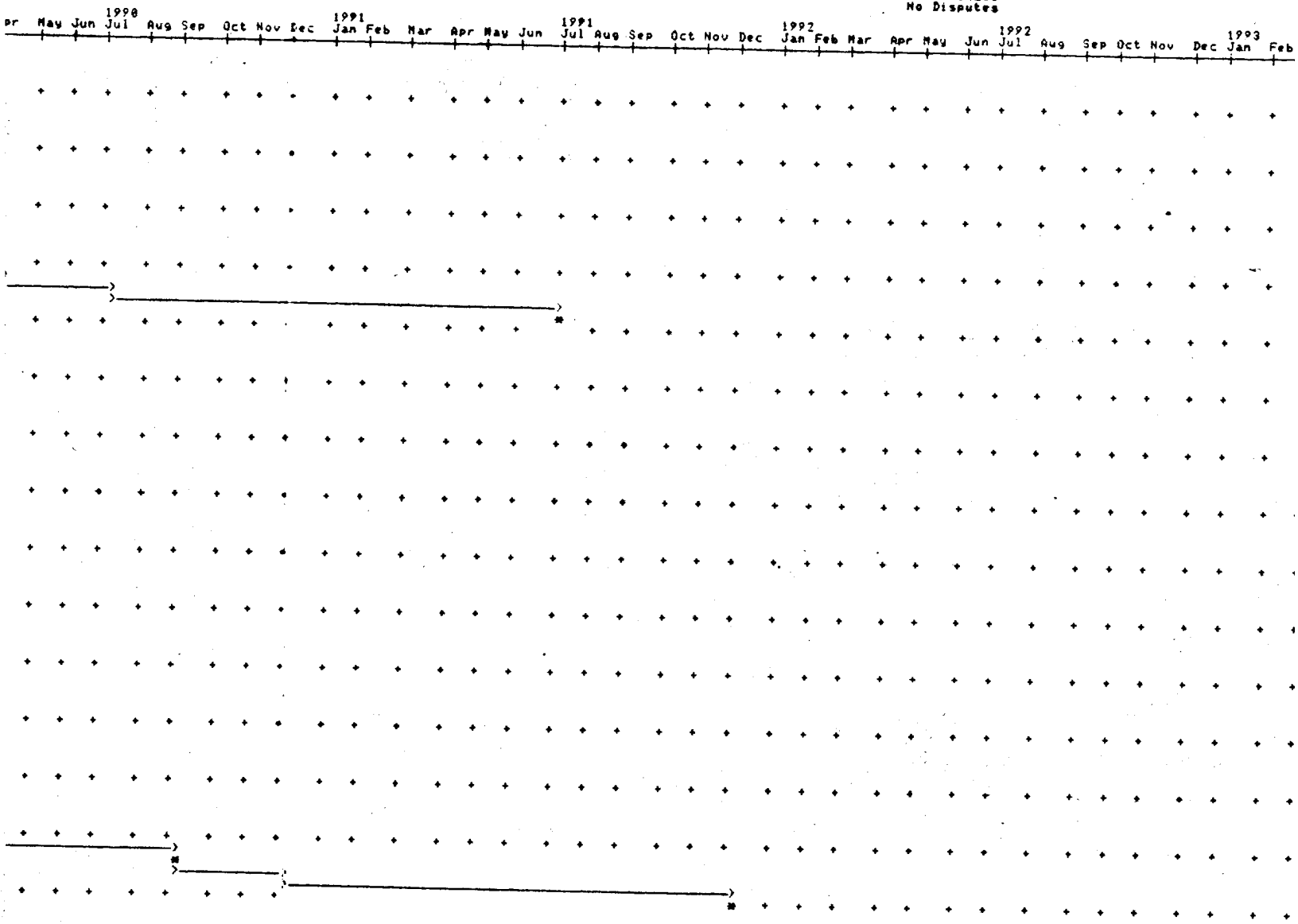
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IRA PROCESS
No Disputes

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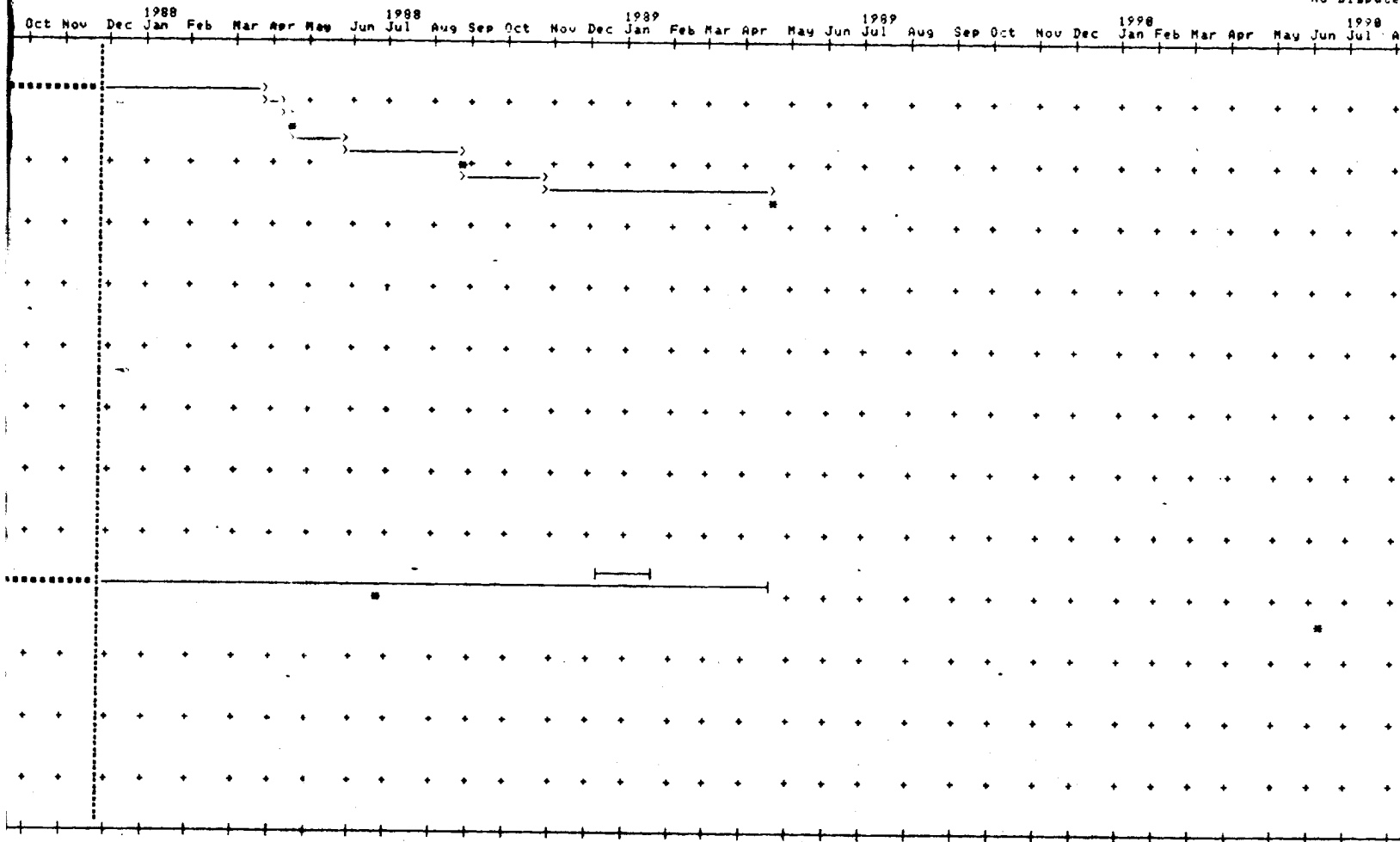
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348 IR-13-02 NOA Evaluation
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350 IR-13-04 Select Lead Party
351 IR-13-05 Army Selects ARARs
352 IR-13-12 Conduct Assesmt (Incl New Contr)
353 IR-13-13 ** End Date for RI Sect 36 **
354 IR-13-14 ** End Date for EA **
355 IR-13-15 ** End Date for PS Dev Alt **
356 IR-13-16 NOA Review Assessment/ARARs
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358 IR-13-25 Finalize ARARs
359 IR-13-26 Prepare Draft IRADD
360 IR-13-29 NOA & Public Comment
361 IR-13-30 Prepare Draft Final IRADD
362 IR-13-31 Dispute/Finalize IRADD
363 IR-13-32 Dispute Meetings IRADD
364 IR-13-33 Revise/Reissue IRADD
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366 IR-13-35 Begin IRA
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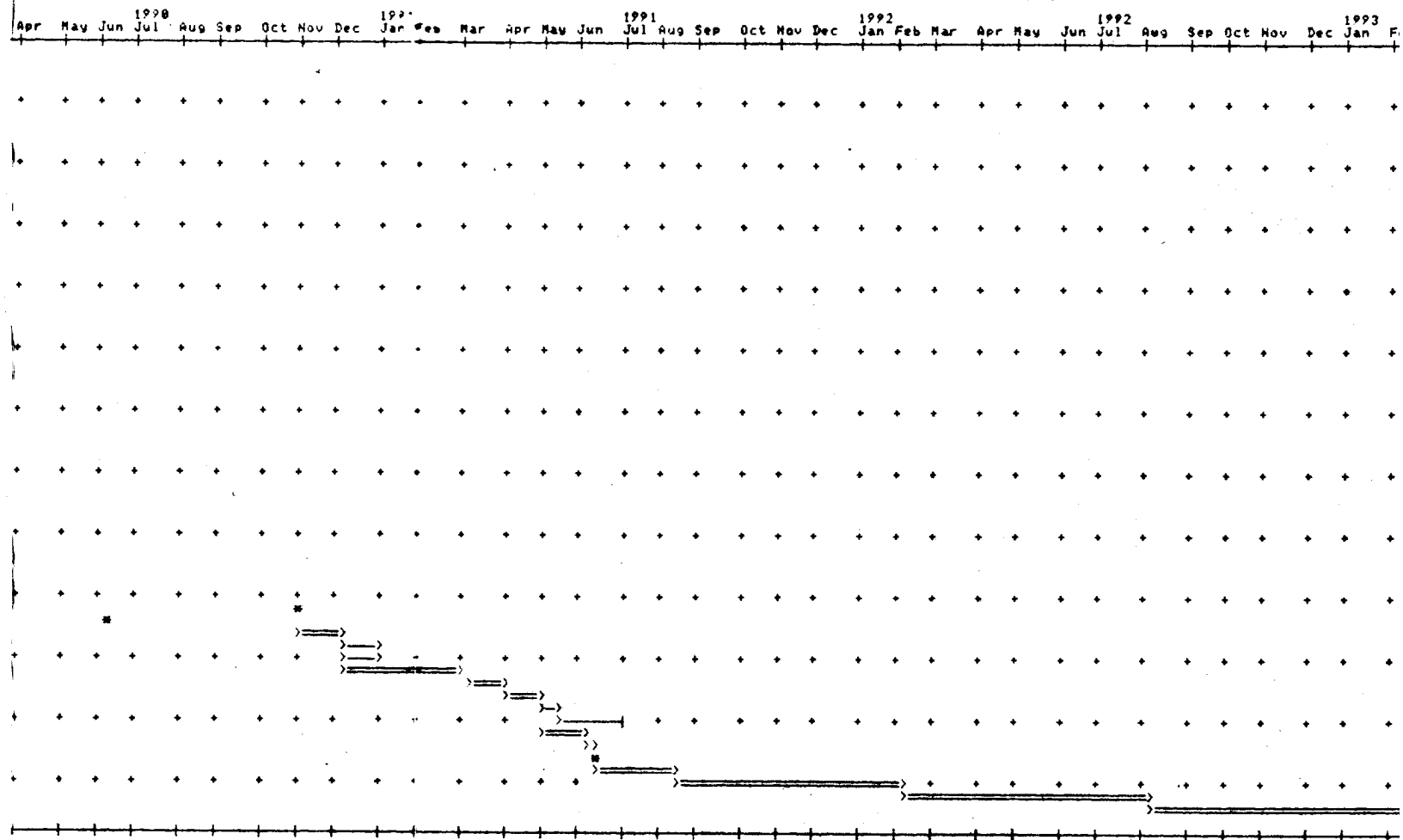
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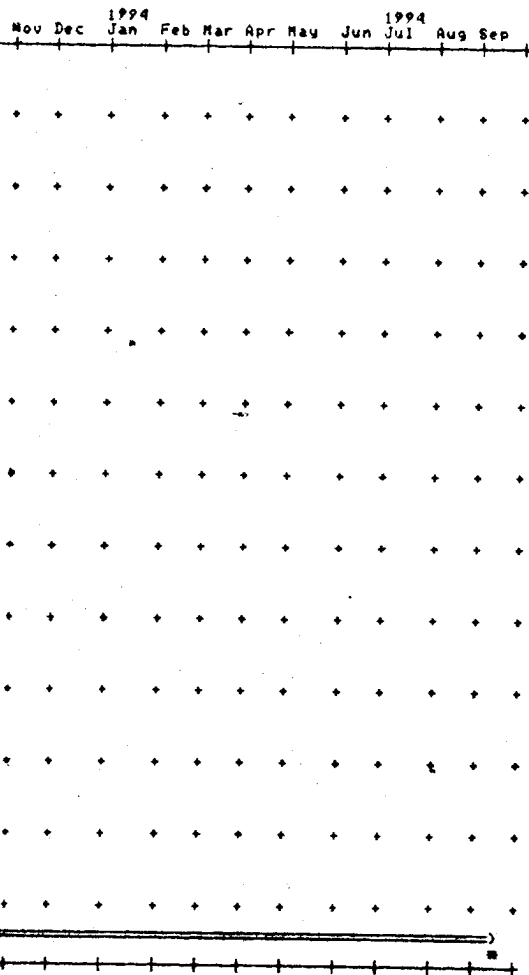
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